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(PCT Rule 61.2)

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Date of mailing (day/month/year)

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Applicant

REINHOLD, Theodore, William

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

03 April 2000 (03.04.00) -



in a notice effecting later election filed with the International Bureau on:

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AMENDED CLAIMS

[received by the International Bureau on 2 February 2000 (02.02.00);
original claims 9, 10 and 14 amended;
new claims 28 to 31 added; remaining claims unchanged (7 pages)]

- ins Aly*
1. Garden refuse shredding apparatus including:-
 - a chamber having a refuse inlet and an outlet for shredded material;
 - a fan for creating an outflow of air from said outlet
 - a shredding rotor supported for rotation in the chamber;
 - at least one elongate chipper blade fixed for rotation with the rotor and extending inward from adjacent the outer periphery of the rotor;
 - a respective blade aperture through the rotor in front of the or each chipper blade through which material shredded by the chipper blade may pass;
 - a feed hopper for directing refuse through said refuse inlet into the chamber in the path of the chipper blade or blades. and
 - drive means for rotating the rotor.
 2. Garden refuse shredding apparatus as claimed in claim 1, wherein:-
 - the fan includes fan blades supported on the rotor and induces an air flow through the feed hopper so as to assist in induction of material introduced to the feed hopper into the housing;
 - the chamber is formed so as to provide an expanding outflow passage to said outlet, and
 - each elongate chipper blade extends inward from adjacent the outer periphery of the rotor substantially to or beyond the half radius position on the rotor.
 3. Garden refuse shredding apparatus as claimed in claim 1 or claim 2, wherein the shredding rotor is supported for rotation about an upstanding axis, the feed hopper extends upwardly from an upper end wall of the chamber and the fan blades are mounted on the shredding rotor at the side thereof remote from the feed hopper.

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4. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the shredding rotor is mounted for direct drive from the output shaft of the drive motor.
5. Garden refuse shredding apparatus as claimed in claim 4, wherein the drive motor is a vertical crankshaft internal combustion engine supported above the chamber, and wherein the shredding rotor is fixed to a hub which rotates with the output shaft of the motor and which is supported by a bearing independent of the motor.
6. Garden refuse shredding apparatus as claimed in claim 5, wherein both the motor and the bearing supporting the hub are supported by the upper end wall of the chamber.
7. Garden refuse shredding apparatus as claimed in any one of claims 4 to 6, wherein the bearing supporting said hub isolates the end and radial loads applied by the shredding rotor from the engine.
8. Garden refuse shredding apparatus as claimed in any one of claims 4 to 7, wherein the bearing is a self-aligning bearing which is locked to the hub.
9. Garden refuse shredding apparatus as claimed in any one of claims 5 to 8, wherein the engine is supported in spaced relationship above the hub and the feed hopper directs refuse through a lower inclined portion extending inward beneath the engine to said refuse inlet.
10. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the drive motor is an electric motor and the rotor is driven directly from the output shaft of the motor.
11. Garden refuse shredding apparatus as claimed in any one of claims 3 to 10, wherein the shredding rotor is suspended from a nominally horizontal upper

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end wall of an upper housing part within a chamber formed between the upper housing part and a lower housing part and wherein the housing parts may be separated to expose the shredding rotor.

12. Garden refuse shredding apparatus as claimed in claim 11, wherein the upper end wall also supports the motor and the hopper and wherein the upper housing part is hingedly connected to the lower housing part for pivotal separation to expose the shredding rotor.

13. Garden refuse shredding apparatus as claimed in claim 12, wherein the lower housing part is supported on skids or wheels.

14. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein:

the chamber has an end wall extending across the blade mounting face of rotor and through which the feed hopper directs refuse into the chamber;

an annular barrier wall is fixed to said end wall and extends about the portion of the hub exposed between said end wall and the rotor;

complementary disrupting members are supported on the end wall and the rotor outwardly of the annular barrier wall but inwardly of the chipper blades, the complementary disrupting members forming stationary members and fixed rotor members respectively which pass closely adjacent one another upon rotation of the rotor.

15. Garden refuse shredding apparatus as claimed in claim 14, wherein each said fixed member is a substantially cylindrical projection extending from said end wall and each said stationary members is a blade member which passes closely adjacent the outer and end faces of the cylindrical projection.

16. Garden refuse shredding apparatus as claimed in claim 15, wherein the cylindrical head of a high tensile cap screw or bolt passing through said end wall forms a said cylindrical projection.

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17. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the chamber is a volute shaped chamber which provides an expanding path for shredded refuse to an outlet from the chamber.

18. Garden refuse shredding apparatus as claimed in any one of the preceding claims and including an anvil across the trailing end of said inlet which cooperates with said chipper blades.

19. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the inlet and each chipper blade extends across two-thirds of the rotor's radial extent.

20. A method of inhibiting entwinement of elongate articles about the drive shaft of rotary processing members, the method including:-

forming a barrier wall about the drive shaft to substantially conceal access between the walls from and to which the drive shaft extends to the rotary processing member, and

providing complementary disrupting members on the respective walls from and to which the drive shaft extends to the rotary processing member, the disrupting members comprising fixed and stationary members which pass closely adjacent one another upon rotation of the rotary processing member so as to disrupt material tending to pass to the drive shaft.

21. Rotary processing apparatus of the type including a drive shaft extending from a fixed wall to an adjacent wall of a processing member driven for rotation by the drive shaft, the rotary processing apparatus including:-

a barrier wall mounted on one of said fixed or adjacent walls about the drive shaft and terminating close to the other wall, and

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complementary disrupting members extending from respective said fixed and adjacent walls so as to pass closely adjacent one another upon rotation of the adjacent wall relative to the fixed wall.

22. A rotary processor such as garden refuse shredder having a driven shaft driving a shredder mounted within a housing, an inlet to the housing for refuse to be shredded and an outlet from the housing for discharging shredded refuse, wherein:-

impeller means are associated with the shredder for inducing an inflow to the housing through the inlet and an outflow from the housing through the outlet.

23. Garden refuse shredding apparatus including:-

a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads the or each respective chipper blade;

a feed hopper for directing refuse into the chamber in the path of the chipper blade or blades;

an electric motor for rotating the rotor;

a friction brake biased to an engaged attitude with the shredding rotor so as to cause the shredding rotor to slow quickly once electrical power to the driving motor has ceased;

a manual on/off control associated with an onboard electrical switch which controls the supply of electricity to the electric motor and with the friction brake whereby movement of the control to the on position for supplying electricity to the motor moves the friction brake from its engaged attitude to a disengaged attitude.

24. Garden refuse shredding apparatus as claimed in claim 22, wherein the friction brake includes a single brake shoe carried on a lever for movement to and from its engaged attitude and wherein the lever co-operates with an electrical switch in its disengaged position to supply electricity to the motor.

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25. Garden refuse shredding apparatus as claimed in claim 24, wherein the friction brake is suitably arranged as a leading shoe brake.

26. Garden refuse shredding apparatus as claimed in any one of claims 23 to 25, wherein the shredding rotor is supported within a shredder housing which is opened to provide service access to the shredding rotor and a latching arrangement is provided for holding the brake lever or other manual on/off control when in the on position in a blocking position blocking the opening of the shredder housing.

27. Garden refuse shredding apparatus including:-

a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads to or each respective chipper blade;

a feed hopper for directing refuse into the chamber in the path of the chipper blade or blades, and

drive means for rotating the rotor.

28. Garden refuse shredding apparatus including:-

a chamber confined by a housing having a refuse inlet and an outlet for shredded material;

a shredding rotor supported for rotation in the chamber;

at least one elongate chipper blade fixed for rotation with the shredding rotor and extending inward from adjacent the outer periphery of the rotor;

a respective blade aperture through the rotor in front of the or each chipper

blade through which material shredded by the chipper blade may pass for discharge through the outlet;

a refuse feed hopper having a lower inclined portion which extends inwardly to the refuse inlet for directing refuse through said refuse inlet into the chamber in the path of the chipper blade or blades;

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a fan having fan blades supported on the rotor for inducing an air flow through the or each blade aperture and the feed hopper;

an extension shaft fixed for rotation with the output shaft of a vertical crankshaft internal combustion engine and extending from the engine to the rotor through a bearing mounted by the chamber housing and supporting the rotor, and wherein:

the or each elongate chipper blade, the associated blade aperture and the refuse inlet extend inward from adjacent the outer periphery of the rotor substantially to or beyond the half radius position of the rotor;

the vertical crankshaft internal combustion engine is elevated above the chamber so as to clear the lower inclined portion of the feed hopper.

29. Garden refuse shredding apparatus as claimed in claim 28, wherein the chamber is formed so as to provide an expanding outflow passage to said outlet.

30. Garden refuse shredding apparatus as claimed in claim 28 or claim 29 and wherein the fan includes a fan blade which extends from an inner position adjacent the inner end of each blade aperture to an outer position adjacent the outer periphery of the rotor and trailing the inner position of the fan blade.

31. Garden refuse shredding apparatus as claimed in any of claims 28 to 30, wherein:

the chamber housing has an end wall extending across the blade mounting face of rotor and through which the refuse inlet extends;

an annular barrier wall is fixed to the end wall and extends about the extension shaft exposed between the end wall and the rotor, and

complementary disrupting members are supported on the end wall and the rotor outwardly of the annular barrier wall but inwardly of the chipper blades, the complementary disrupting members forming stationary members and fixed rotor members respectively which pass closely adjacent one another upon rotation of the rotor.

AMENDED SHEET (ARTICLE 19)

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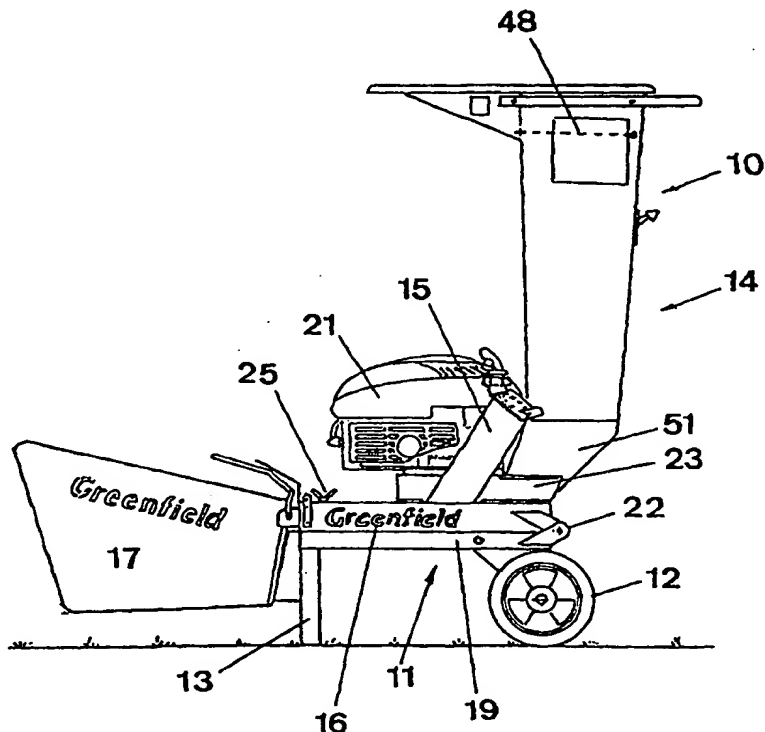
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(54) Title: GARDEN REFUSE SHREDDING APPARATUS

(57) Abstract

This invention provides garden refuse shredding apparatus (10) which has a chipping rotor (20) supported for rotation about a vertical shaft (31) in a chamber (11) which has a hopper (14) which feeds refuse to radially disposed elongate chipper blades (30) which span a major part of the rotor (28). Fan blades (44) are supported on the rotor for creating an airflow through the hopper (14) to assist feed to the chipping rotor and to assist discharge of shredded refuse from the outlet (45). The chipping rotor (20) is driven directly from the vertical output shaft (36) of an electric motor or a petrol engine (21).



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GARDEN REFUSE SHREDDING APPARATUS

TECHNICAL FIELD

This invention relates to garden refuse shredding apparatus suitable for shredding leaves twigs palm fronds and small branches.

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BACKGROUND ART

Many types of garden refuse shredders are currently available and typically they include an inlet hopper which can be loaded with garden refuse for shredding as well as a small bore inlet tube for introducing small branches to be shredded. Mostly
10 these machines utilise a flail assembly at the base of the hopper for shredding material fed through the hopper and a separate chipper assembly at the base of the small bore inlet tube for chipping small branches introduced therethrough.

Disadvantages associated with these types of shredders stems from their relative complexity often making servicing, such as drive belt and blade sharpening
15 operations, difficult and unreliable. Furthermore the flail assembly is often readily accessible from the underside of the machine making them dangerous for operation around children. In addition the flail assembly shreds green leafy material to a very fine form which may not be the most suitable for garden mulching operations

Attempts have also been made to provide garden refuse shredding apparatus
20 based on a simple shredding rotor such as is used in domestic rotary mowers. However because of the nature of materials which are fed to such apparatus such as long fibrous articles including palm fronds, long grass and tree refuse, it is common for the material to become entangled about the drive shaft of the spinning rotor. This entanglement can build up to such extent that it jams the machine and
25 prevents further operation thereof or substantially reduces the efficiency of operation of the processor.

In some instances such entanglement about a drive shaft can damage seals and the like which extend about that drive shaft. Any build-up of such refuse is also undesirable as it will impede the throughput of refuse and cause fouling about the
30 drive shaft.

Garden refuse shredders and other driven garden appliances are often operated by stand-alone petrol engines and electric motors fed by a power cord from the mains. Mains fed electric motors may be switched on and off remotely from the

implement without knowledge of the user. This can lead to dangerous operating conditions as when operated many such electrical implements operate relatively silently. Inadvertent contact with a active parts of the implement may result with consequent injury to a user. This is particularly so in the case of garden refuse shredders where operators may wear ear muffs and where the spinning chipper rotor if contacted may cause instant serious injury.

While it is possible to provide override switches and the like to minimise such accidental occurrences, it is difficult to shield against careless operating practices while maintaining simplicity and reliability of the apparatus.

Aspects of the present invention aim to alleviate one or more of the above disadvantages and/or to provide garden refuse shredding apparatus which will be reliable and efficient in use.

DISCLOSURE OF INVENTION

With the foregoing in view, this invention in one aspect resides broadly in garden refuse shredding apparatus including:-

a chamber having a refuse inlet and an outlet for shredded material;

fan means for creating an outflow of air from said outlet

a shredding rotor supported for rotation in the chamber;

at least one elongate chipper blade fixed for rotation with the rotor and extending inward from adjacent the outer periphery of the rotor;

a respective aperture through the rotor in front of the or each chipper blade through which material shredded by the chipper blade may pass;

a feed hopper for directing refuse through the refuse inlet into the chamber in the path of the chipper blade or blades, and

drive means for rotating the rotor.

Suitably the fan means are supported on the rotor and induce an air flow through the feed hopper so as to assist in induction of material introduced to the feed hopper into the housing and each elongate chipper blade extends inward from adjacent the outer periphery of the rotor substantially to or beyond the half radius position of the rotor.

Alternatively an air flow may be induced by an exhaust fan associated with the outlet from the chamber and air may be introduced either through the hopper or

elsewhere. The induction may be such as to cause the feed of refuse from a storage into the chamber or the feed hopper may feed gravitationally into the chamber and the air flow may be used to assist induction of the refuse into the chamber.

5 The shredder may include a pipe inlet through which branches and the like are fed to the shredding rotor which is suitably in the form of a heavy rotor having one or more relatively long chipper blades mounted thereon adjacent a complementary aperture through the rotor.

10 The or each chipper blade suitably has an outer portion which passes across the pipe inlet and the outer portion of the inlet, while the inner portion of the chipper blades passe only across the inner portion of the inlet. For example the inlet is suitably part-circular and extends across about between one-half and three-quarter of the rotor's radial extent, while the pipe inlet extends across about the outer one-quarter to one-half of the rotor's radial extent. More suitably the inlet extends across two-thirds of the rotor's radial extent, while the pipe inlet extends across one-third of
15 the rotor's radial extent.

In one desired form which utilises gravity feed of refuse to the chamber, the feed hopper extends upwardly from an upper end wall of a chamber in which a shredding rotor is supported for rotation about an upstanding axis and fan blades are mounted on the shredding rotor at the side thereof remote from the feed hopper, the
20 fan blades forming the fan means.

The shredding rotor may be supported for rotation about a horizontal axis or an inclined axis. It is preferred that the shredding rotor be mounted for direct drive from the output shaft of the drive motor which may be an electric motor or an internal combustion engine. In the case of an internal combustion engine it is preferred that
25 the shredding rotor be fixed to a hub which rotates with the output shaft of the motor. Suitably the hub extends about the output shaft and is supported by a bearing mounted to an end wall of the chamber.

The chipper rotor and bearing may be supported on the lower end wall and be connected to the motor such as by a splined or dog connection. Suitably however
30 both the motor and the bearing for the hub are mounted to the upper end wall of the chamber containing the shredding rotor. Preferably the bearing is of the type which isolates end and radial loads applied by the shredding rotor from the engine. In this

manner the outer end of the output shaft is supported by the hub bearing against loads imposed by the rotor.

Preferably the hub bearing is a self-aligning bearing of the type which may be locked to the hub, such as a self-aligning cam-lock sealed ball bearing, which is
5 locked to the hub after adjusting end play of the engine shaft so as to reduce end loads being transferred to the crankshaft of the engine. For this purpose it is preferred that the engine is supported on a bracket above the hub bearing in such manner that access may be gained to the hub bearing for locking purposes after
10 securing of the rotor to the output shaft. This arrangement provides a very simple and cost effective means of achieving reliable operation with direct drive from an internal combustion engine.

It is desirable that the shredding rotor be provided with means to prevent stringy material from becoming entangled about the hub of the rotor. In one form this includes the provision of macerator blocks or blades mounted on the rotor and co-
15 acting with complementary fixed blocks or blades mounted on the end wall of the rotor housing.

In a particular embodiment of the invention the shredding rotor is enclosed for rotation within a two part housing and is supported for rotation from a nominally horizontal upper end wall of an upper housing portion which also carries the motor
20 and the hopper and which is hinged to a lower housing portion from which the upper housing portion may be pivoted to an open position to expose the shredding rotor. In this form the lower housing part is suitably supported on skids or wheels.

This configuration of the rotor housing also constitutes another aspect of this invention and may be utilised to advantage without being limited to utilising the
25 particular shredding apparatus described above.

Similarly the configuration of the motor and rotor mounting utilising a separate bearing to isolate the rotor loads from the direct mounted motor shaft constitutes a further aspect of this invention and may be utilised to advantage without being limited to utilising the particular shredding apparatus or housing described above.

30 It is also preferred that in this form the upper housing parts be provided with suspension means for suspending a catcher across an outlet aperture in a side wall of the housing. Suitably the catcher is mounted remote from the hinging mechanism and preferably the outlet constitutes the end of a volute shaped housing which

provides an expanding path to the outlet. It is also preferred in such arrangement that an induced air draught by utilised to assist in feed through the feed hopper and discharge of shredded material through the outlet.

5 In a further aspect this invention resides broadly in a method of inhibiting entwinement of elongate articles about the drive shaft of rotary processing members, the method including:-

forming a barrier wall about the drive shaft to substantially conceal access between the walls from and to which the drive shaft extends to the rotary processing member, and

10 providing complementary disrupting members on the respective walls from and to which the drive shaft extends to the rotary processing member, the disrupting members comprising fixed and stationary members which pass closely adjacent one another upon rotation of the rotary processing member so as to disrupt material tending to pass to the drive shaft.

15 The disrupting members may be arranged between the drive shaft and the barrier wall or at the side of the barrier wall which is remote from the drive shaft. Suitably the access path across the barrier wall and past the disrupting members in a circuitous or labyrinth path.

The complementary disrupting members may be a plurality of substantially
20 identical complementary disrupting members arranged concentrically about the drive shaft. Each of the complementary disrupting members may be a pair of anvil members which rotate past one another such as a pair of opposed pins or blades.

Suitably each of the complementary disrupting members includes a fixed anvil member such as a cylindrical projection and a blade member which passes closely
25 adjacent exposed side and end faces of the cylindrical projection. In one embodiment the or each cylindrical projection is constituted by the cylindrical head of a high tensile cap screw or bolt.

The method of inhibiting entwinement of elongate articles about the drive shaft of rotary processing member may also include providing air flow or pressure
30 distribution arrangements about the drive shaft whereby matter disrupted by the complementary disrupting members is induced to flow away from the drive shaft.

In another aspect, this invention resides broadly in rotary processing apparatus of the type including a drive shaft extending from a fixed wall to an

adjacent wall of a processing member driven for rotation by the drive shaft, the rotary processing apparatus including:-

a barrier wall mounted on one of said fixed or adjacent walls about the drive shaft and terminating close to the other

5 wall, and

complementary disrupting members extending from respective said fixed and adjacent walls so as to pass closely adjacent one another upon rotation of the adjacent wall relative to the fixed wall.

10 A plumber block or the like bearing is suitably mounted on top of a horizontal fixed wall so as to support the rotary processing apparatus and cap screws, ie screws or bolts having cylindrical heads with a socket for receiving a key or the like, disposed equidistant from the axis of the drive shaft pass upwardly through the fixed wall into the base of the plumber block or the like and act as fixed disrupting members which cooperate with blades mounted on the adjacent wall. Suitably the
15 blades have a horizontal part which terminates close to the outer ends of the cap screws and a vertical part which terminates close to the side walls of the cap screws.

In yet a further aspect this invention resides broadly in a rotary processor such as garden refuse shredder having a driven shaft driving a shredder mounted within a housing, an inlet to the housing for
20 refuse to be shredded and an outlet from the housing for discharging shredded refuse, wherein:-

impeller means are associated with the shredder for inducing an inflow to the housing through the inlet and an outflow from the housing through the outlet. Suitably the housing provides an expanding travel path for material entering through
25 the inlet and passing to the outlet and more suitably this travel path is in the form of a volute or the like. The drive shaft may be driven by an electric motor or by an internal combustion engine, in which case it is preferred that the shredder be mounted on the output shaft but supported by bearing means independent of the internal combustion engine. The drive shaft may be a horizontal shaft or a substantially vertical shaft.
30 The shredder is suitably a relatively heavy disc supporting chipper blades thereon and having apertures therethrough in front of the blades and through which shredded refuse may pass to be discharged.

In an electrically driven form of this invention in which the shredding rotor is supported on the output shaft of an electric motor, the shredding rotor suitably includes a friction brake biased to an engaged attitude so as to cause the shredding rotor to slow quickly to a stopped position once electrical power to the driving motor has ceased and a manual on/off control associated with an onboard electrical switch which controls the supply of electricity to the motor such that when the control is moved to the on position for supplying electricity to the motor the brake is maintained in a disengaged position and when the control is moved to the off position the brake is freed for stopping the shredding rotor.

Suitably the brake is a single shoe brake carried on a lever for movement to and from its engaged attitude and co-operable with a switch in its disengaged position to supply electricity to the motor. The brake is suitably arranged as a leading shoe brake such that the effort to operate the brake effectively is reduced.

The shredding rotor may also be supported within a shredder housing which is opened to provide service access to the shredding rotor and suitably a latching arrangement is provided for holding the brake lever or other manual on/off control when in the on position in a blocking position blocking the opening of the shredder housing.

The shredding rotor may be supported in a volute shaped housing and be provided with wind vanes for creating an air flow therethrough from the refuse inlet to the outlet from the shredder housing.

A barrier wall may be provided about the output shaft of the motor as a guard against elongate fibrous articles becoming entwined about the shaft. Cutters mounted on the rotor of the shredding rotor and arranged to pass across fixed anvils may be provided to disrupt fibrous articles that pass toward the output shaft also with a view to preventing elongate fibrous articles becoming entwined about the shaft and in a further aspect of this invention the cutters are suitably in the form of hardened plates extending upwardly through slots through the rotor to pass close to the fixed anvils. Each plate may be welded to a mounting flange which is bolted to the underside of the rotor and preferably with bolts which trail the plate.

BRIEF DESCRIPTION OF DRAWINGS

In order that this invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a typical embodiment of the invention and wherein:-

Fig. 1 is a side view of the shredding apparatus fitted with a catcher;

Fig. 2 is corresponding view but shown without a catcher;

Fig. 3 illustrates the shredding apparatus disposed in a servicing mode;

Fig. 4 is a part-sectional view of the rotor and its mounting;

Fig. 5 is a cutaway plan view of the rotor assembly, and

FIGS. 6 and 7 illustrates in plan and side sectional views a further embodiment of the rotor assembly.

FIGS. 8 and 9 illustrates in plan and side sectional views a further embodiment of the rotor assembly and its mounting details;

FIG. 16 illustrates an electrically operated shredder in an operative mode;

FIG. 17 is a corresponding view but in an inoperative mode;

FIG. 18 illustrates the shredder in an open servicing mode;

FIG. 19 is a similar view to Fig. 3 but shown with the rotor removed;

FIG. 20 is a top view of the shredding rotor assembly, and

FIG. 21 is an underneath view of the brake assembly.

MODES FOR CARRYING OUT THE INVENTION

The garden refuse shredding apparatus 10 illustrated in the drawings has a two-part housing 11 supported on rear wheels 12 and a front stand 13, a feed hopper assembly 14 and a small bore inlet tube 15 extending upwardly from the upper housing part 16 and a catcher 17 suspended from the front of the housing 11.

The housing 11 contains a shredding rotor assembly 20, illustrated in Fig. 4, and supports a small petrol motor 21 thereabove for driving the shredding rotor assembly 20. Opposed pin hinges 22 attach the upper housing part 16 to the lower housing part 19 at the rear thereof which enable the upper housing part 16 and the components mounted thereon to fold to an open position, as illustrated in Fig. 3, at which the handle 24 rests on the ground and clear access is provided to the shredding rotor assembly 20 through the open underside of the top housing part 16.

The front of the top housing part 16 is retained on the lower housing part 19, in use, by bolts 25.

As illustrated in Figs. 4 and 5, the shredding rotor assembly 20 has a disc-like rotor 28 formed with opposed radially extending slots 27 at diametrically opposite positions and a chipper blade 30 bolted to the rotor 28 adjacent the trailing side of each slot 27.

Macerator blocks 29 are interposed between the blades 30 and are fixed to the rotor 28 with inner ends spaced from the hub 31 to which the rotor 28 is bolted. Pins 32 extends down from the end wall 33 of the upper housing part 16 toward the rotor 28. The pins are positioned between the hub 31 and the macerator blocks 29.

The hub 31 is formed at the lower end of a thick-walled sleeve 35 which is bored to accept the output shaft 36 of the motor 21 which is keyed thereto by a key in conventional manner. The lower end of the motor shaft 36 is threaded to receive a retaining bolt 37 which pulls the rotor 28 against the end of the shaft 36. The rotor is also bolted to the hub 31 by bolts 38.

The sleeve 35 is supported by a large capacity self-aligning cam-lock bearing 40 which is secured to the end wall 33 through a stiffening boss 41. This bearing is locked to the motor shaft 36 so as to support the weight of and end thrust placed upon the rotor 28.

The bearing 40 also accommodates the side and impact loads imparted by the operation of the chipper blades 30. This isolates undesirable loads being applied to the crankshaft of the directly mounted motor 21 which is supported on a channel shaped mounting 23 fixed to the end wall 33. The rotor 28 is relatively heavy and acts as a flywheel and in a typical embodiment is formed from 5mm thick steel plate.

The underside of the rotor 28 has impeller blades 44 bolted thereto so as to create an air flow through the open front 45 of the housing 11. This induces a downdraught through the feed hopper assembly 14 and the small bore inlet tube 15 which assists in feeding material to be mulched therethrough toward the rotor 28. A closure cap may be provided for the tube 15 to increase the draught through the hopper assembly 14.

The induced draught also carries shredded material through the outlet which is normally closed by a flap 47 hinged along its upper edge and pivotable upwardly to

permit a conventional grass catcher 50 to be removably clipped to the housing 11 to receive the shredded material

It will be seen that the feed hopper assembly 14 has a forwardly convergent transition piece 51 extending from its underside to the inlet aperture 52 formed in the top wall 33, while the inlet tube 15 is angled back to assist feeding of the material introduced therethrough.

In use when the rotor 28 is rotated at high speed, air is induced to flow through the feed hopper assembly 14 and inlet tube 15, which may be capped if desired. This air flow assists in the feeding of material to be shredded to the rotor 28. Most of this matter will be shredded by the chipper blades 30 and pass through the apertures 27 for discharge to the catcher.

Should refuse move across the top of the rotor 28 toward the hub 31 it will be contacted by the macerator blocks 29 and be pulverised. The air draft induced by the fan blades 44 will assist in discharging the pulverised material.

In the event that the chipper blades need servicing, they can be accessed easily by releasing the bolts 25 and pivoting the top housing part to its open position as illustrated in Fig. 3. In this position the rotor 28 is stably supported for safe working conditions.

An inlet safety flap 48 is pivotally attached to the upper end of the hopper to close the hopper after the addition of material to be shredded. The flap 48 does not extend fully to the front wall 53 of the hopper 14 so as to provide an opening or air flow gap for maintenance of a desirable air flow through the feed hopper 14 to assist with the feeding and/or discharge process.

An alternate rotor 58 illustrated in Figs. 6 and 7 carries opposed blades 56 formed with upturned inner ends 57 to provide cutters which co-act with complementary arcuate blade 59 centred on the rotor axis and fixed to the end wall 55 of the upper housing part. The cutters 57 pass close to the blades 59 and cut up long strands of matter which may be fed toward the boss 54. However the rotor arrangements of Figs. 4 to 7 are not particularly suited to coping with various types of refuse such as palm fronds for example. These are more efficiently coped with by the shredding rotor assembly illustrated in Figs. 8 to 13 and described below.

The preferred form of shredding rotor assembly 60 has opposed blades 61 bolted to the rotor 69 and formed with upturned cutting or disrupting ends 62 which

are L-shaped to pass closely about the end face 63 and side face 64 of circular anvils 65 which in this embodiment are constituted by Allen head bolts which bolt the end wall 66 to the robust housing of the cam-lock nearing 67. The bolts 65 are high tensile bolts which have relatively deep serrated cylindrical heads. With this arrangement the close spacing between the L-shaped ends 62 with the side and end faces of the bolts 65 will not vary with rotation of the bolts 65.

An annular barrier wall 70 extends down from the end wall 66 to terminate closely adjacent the rotor 69. The barrier wall 70 closely accommodates the lower mounting flange 72 of the hub assembly 71 which is carried by the cam-lock bearing 67. This hub is keyed to the driveshaft 73 of the motor 74 and a central retaining bolt extends through the rotor 69 into the driveshaft 73.

As can be clearly seen in Fig. 10, when the blades 61 are in line with one of the bolts 65 the only path thereacross to the hub assembly 71 is a circuitous or labyrinth path as indicated by the arrow 75, and being first about the side and end face of the bolts 65 and then past the barrier wall 70. This will provide an effective barrier against elongate fibrous articles entwining about the shaft. Material which travels inward beyond the chipper blades 76 will be resisted by the barrier wall 70 where it will be cut up or disrupted and then forced outwardly either by the motion of the rotor or the air flow across the rotor 69. The through bolts for the chipper blades 76 also secure the impeller blades 77 to the rotor 69.

Fig. 12 illustrates the simple and easy to manufacture nature of the shredding apparatus, being formed mostly of folded sheet metal bolted together and punched for bolt on mounting of the components such as the motor and bearing assembly, while Fig. 13 illustrates the ease of servicing the working components which are normally concealed within the rotor housing.

This arrangement provides a shredder of very simple form which has the bulk of its weight centralised between the wheels 12 and the stand 13 for stable operation. The weight of the hopper is offset by the catcher and the handle 24 provides for simple balanced wheeling of the shredder 10 from location to location and support for the opened housing.

As illustrated in Fig. 14, the inlet tube 80 is provided with a pivoted closure flap 81 which normally falls down to a position at which it closes the tube 80, thus assisting in maintaining a relatively high air flow through the inlet chute 14 to assist

flow of refuse to the chipper blades. A coupling 82 at the end of a flexible hose 83 is provided with an external sealing ring 84 and it plugs into the upper end of the pipe 80. The outer end of the hose 83 terminates in a suction nozzle and handle assembly such as is illustrated diagrammatically at 85. Blocking means may also be provided for the partially open inlet chute to assist in creating a suitable vacuum effect at the nozzle 85.

In order to convert the shredder for use as a refuse blower, as shown in Fig. 15 a transition housing 90 is attached to the mountings 91 for the grass catcher and converges to a tubular outlet pipe 92 to which a flexible hose 93 and nozzle assembly 94 may be connected. The nozzle 94 is associated with a handle 95 for manipulation by a user. Thus the air draft created by the fan blades can be used to advantage as a concentrated stream for blowing surfaces clean of loose refuse.

The garden refuse shredder assembly 110 illustrated in Figs. 16 to 21 of the drawings has a shredding rotor assembly 111, as illustrated in Fig. 20 supported in a housing 112 and driven by an electric motor 113. An inlet chute 114 is provided at the rear of the housing for entry of garden refuse and an outlet chute 115 is provided at the front of the housing through which shredded material is discharged.

In this embodiment, the housing 112 is a two part housing having an upper part 120 pivotally connected by pivots 121 to a base part 122 such that the upper part 120 may be opened as shown in Figs. 18 and 19 to provide access to the shredding rotor assembly 111. Normally the housing parts are retained in their closed attitude by a pair of wing nuts which bolt the upper part 120 to the base part 122.

Referring to Fig. 19 it will be seen that the shredding rotor assembly 111 is contained within a volute shaped housing 124 formed with an expanding discharge chute 125 extending to the outlet 115. Fig. 19 also illustrates the inlet 126 for refuse to be shredded and the anvil 127 which is bolted to the trailing edge of the inlet 126 and which chipper blades 128 of the shredding rotor assembly 111 co-operate to shear refuse fed through the inlet 126.

As shown in Fig. 18 the base part 122 is provided with an upstanding pin 130 which passes through a complementary aperture 133 in the upper housing portion 120 when the housing is closed. The upper end 131 of the pin 130 is then exposed above the upper housing 120 as illustrated in Figs. 16 and 17.

The shredding rotor assembly 111 is provided with a mounting hub 135 which receives the keyed output shaft of the electric motor 113. The upper portion of the hub 135 extends upwardly above the housing 120 into a cavity formed by an inverted channel shaped motor mounting bracket 136. The motor mounting bracket supports a brake lever 137 which carries a brake pad 138 and tension spring 139 which biases the brake pad 138 into engagement with the upper portion of the hub 135.

The brake lever 137 extends forwardly through the front flange 140 of the motor bracket 136 and beyond the exposed upper end 131 of the pin 130 which projects through the housing 120. An on/off switch 141 is also carried on the motor mounting bracket so as to co-operate with the brake lever such that when the brake lever is disengaged from the hub 135 and held in the "ON" position, it will actuate the switch 141 to an on position such that external electrical power supplied to the shredder will be switched to the motor 113.

When the lever 137 returns to the engaged position, it releases from the switch 141 which becomes open circuit so as to prevent supply of electricity to the motor 113. Once disengaged from an "ON" position, the biasing of the lever 137 will urge the brake pad 138 into braking contact with the hub 135 to brake the rotor assembly 11 to a standstill in a relatively short space of time, such as a matter of seconds.

The end 145 of the lever 137 which is exposed above the housing part 120 forms an on/off control switch for the shredder and it is adapted to be retained in the "ON" position by engaging it with the exposed upper end 131 of the pin 130. For this purpose, the upper end 131 of the pin 130 is waisted at 150 and the end 145 of the lever is provided with a keyhole slot 151 whereby the end portion 145 may be captively engaged with the upper end 131 of the pin 130 and held therein by its spring bias.

When so engaged, the switch 141 is maintained closed and power is supplied to the motor 130. When the lever end 145 is released from the pin end 131, the spring 139 will pull the lever 137 to the braking position stopping power supply to the motor and at the same time braking the rotor to a standstill.

Should an operator want to gain access to the rotor assembly 111, the operator may undo the wing nuts 142 with a view to pivoting the upper part 120 of the housing 112 to the open position. This may be achieved provided the on/off lever

137 is not engaged about the upper end of the pin 130. If it is so engaged and the electric motor is powered, then captive engagement of the lever end 145 with the pin end 131 will prevent the upper housing part 120 being pivoted to its open position. Thus the housing cannot be opened to gain access to the rotor assembly 11 unless
5 the lever 125 is in the off position.

Accordingly it will not be possible to gain access to the rotor assembly 111 until the power supply to the motor 113 has been disrupted and the rotor has been braked.

Referring to Fig. 21 it will be seen that the brake lever 137 is arranged with the
10 pivot mounting at a leading position relative to the rotation of the hub 135 such that the brake assembly is a leading shoe brake assembly which provides a self servo effect to assist actuation by the tension spring 139.

It will also be seen from the drawings that the rotor assembly 111 operates in the volute shaped housing and is provided with fan blades 161 adjacent the
15 apertures 162 in front of the chipper blades 128. The fan blades induce a draft through the feed chute 114 and through the outlet 115 to assist in through flow and discharge of shredded material.

It will be further seen that an annular barrier wall 163 is formed around the output shaft 164 of the motor 113 so as to shroud the hub 135. Fixed circular anvils
20 which are preferably serrated and constituted by the heads of Allen head bolts 165 are mounted adjacent the barrier wall 163 and complementary L-shaped cutting blades 166 extend through slots 167 in the rotor 11. The blades 166 are welded to mounting plates which are bolted to the rotor 11 by trailing bolts 169. The L-shaped cutters 166 pass closely over the outside and lower end of the circular anvils 165 so
25 as to cut up any fibrous material which may pass through the inlet 126 and move inwards above the rotor 11.

In the illustrated embodiment the outlet 115 is provided with a deflector 170 which deflects discharged material towards the ground. The deflector however may be pivoted to an inoperative position so as to permit a catcher to be engaged with the
30 outlet to receive shredded material.

In operation the upper end of the inlet chute 114 is normally covered by a safety flap which does not prevent flow of air induced by the low pressure created by the fan blade 161. Thus once operating, there is a significant air flow induced in the

inlet chute to assist feed of material to the cutter assembly and from the outlet to assist in discharge of shredded material.

As the material is fed through the inlet, it is engaged between the anvil.127 and a chipper blades 128 and chipped. It is then flung outwardly and discharged with the aid of the induced draft. This operation can only occur when the lever 145 is engaged about the pin 130 as illustrated in Fig. 16. If the operator desires to service the rotor 11, the upper part of the housing 120 cannot be opened until the lever 145 has been freed from the pin 130 for movement to the braking position. Thereafter the wing nuts 142 can be released to enable the housing parts to be opened. A further accessible master switch may be provided if desired to provide an operator with a direct means of switching the power supplied to the shredder assembly 110 on or off. This may be accommodated on the handle of the shredder assembly 110 or placed elsewhere as desired.

It will of course be realised that the above has been given by way of illustrative embodiment of the invention, all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as is defined in the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Garden refuse shredding apparatus including:-
 - 5 a chamber having a refuse inlet and an outlet for shredded material;
 - a fan for creating an outflow of air from said outlet
 - a shredding rotor supported for rotation in the chamber;
 - at least one elongate chipper blade fixed for rotation with the rotor and
extending inward from adjacent the outer periphery of the rotor;
 - 10 a respective blade aperture through the rotor in front of the or each chipper
blade through which material shredded by the chipper blade may pass;
 - a feed hopper for directing refuse through said refuse inlet into the chamber in
the path of the chipper blade or blades, and
 - drive means for rotating the rotor.
- 15 2. Garden refuse shredding apparatus as claimed in claim 1, wherein:-
 - the fan includes fan blades supported on the rotor and induces an air flow
through the feed hopper so as to assist in induction of material introduced to the feed
hopper into the housing;
 - 20 the chamber is formed so as to provide an expanding outflow passage to said
outlet, and
 - each elongate chipper blade extends inward from adjacent the outer periphery
of the rotor substantially to or beyond the half radius position on the rotor.
- 25 3. Garden refuse shredding apparatus as claimed in claim 1 or claim 2, wherein
the shredding rotor is supported for rotation about an upstanding axis, the feed
hopper extends upwardly from an upper end wall of the chamber and the fan blades
are mounted on the shredding rotor at the side thereof remote from the feed hopper.
- 30 4. Garden refuse shredding apparatus as claimed in any one of the preceding
claims, wherein the shredding rotor is mounted for direct drive from the output shaft
of the drive motor.

5. Garden refuse shredding apparatus as claimed in claim 4, wherein the drive motor is a vertical crankshaft internal combustion engine supported above the chamber, and wherein the shredding rotor is fixed to a hub which rotates with the output shaft of the motor and which is supported by a bearing independent of the motor.

6. Garden refuse shredding apparatus as claimed in claim 5, wherein both the motor and the bearing supporting the hub are supported by the upper end wall of the chamber.

7. Garden refuse shredding apparatus as claimed in any one of claims 4 to 6, wherein the bearing supporting said hub isolates the end and radial loads applied by the shredding rotor from the engine.

8. Garden refuse shredding apparatus as claimed in any one of claims 4 to 7, wherein the bearing is a self-aligning bearing which is locked to the hub.

9. Garden refuse shredding apparatus as claimed in claim 8, wherein the engine is supported on an open bracket above the hub bearing whereby access may be gained to the hub bearing for locking the bearing to the hub.

10. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the drive motor is an electric motor and the rotor is mounted directly on the output shaft of the motor.

11. Garden refuse shredding apparatus as claimed in any one of claims 3 to 10, wherein the shredding rotor is suspended from a nominally horizontal upper end wall of an upper housing part within a chamber formed between the upper housing part and a lower housing part and wherein the housing parts may be separated to expose the shredding rotor.

12. Garden refuse shredding apparatus as claimed in claim 11, wherein the upper end wall also supports the motor and the hopper and wherein the upper housing part

is hingedly connected to the lower housing part for pivotal separation to expose the shredding rotor.

13. Garden refuse shredding apparatus as claimed in claim 12, wherein the lower
5 housing part is supported on skids or wheels.

14. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein:

the chamber has an end wall extending across the blade mounting face of
10 rotor and through which the feed hopper directs refuse into the chamber;

an annular barrier wall is fixed to said end wall and extends about the portion of the hub exposed between said end wall and the rotor;

complementary disrupting members are supported on said end wall and the rotor radially outwardly of the annular barrier wall but inwardly of the chipper blades,
15 the complementary disrupting members forming fixed members and stationary members respectively which pass closely adjacent one another upon rotation of the rotor.

15. Garden refuse shredding apparatus as claimed in claim 14, wherein each said
20 fixed member is a substantially cylindrical projection extending from said end wall and each said stationary members is a blade member which passes closely adjacent the outer and end faces of the cylindrical projection.

16. Garden refuse shredding apparatus as claimed in claim 15, wherein the
25 cylindrical head of a high tensile cap screw or bolt passing through said end wall forms a said cylindrical projection.

17. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the chamber is a volute shaped chamber which provides an
30 expanding path for shredded refuse to an outlet from the chamber.

18. Garden refuse shredding apparatus as claimed in any one of the preceding

claims and including an anvil across the trailing end of said inlet which cooperates with said chipper blades.

19. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the inlet and each chipper blade extends across two-thirds of the rotor's radial extent.

20. A method of inhibiting entwinement of elongate articles about the drive shaft of rotary processing members, the method including:-

forming a barrier wall about the drive shaft to substantially conceal access between the walls from and to which the drive shaft extends to the rotary processing member, and

providing complementary disrupting members on the respective walls from and to which the drive shaft extends to the rotary processing member, the disrupting members comprising fixed and stationary members which pass closely adjacent one another upon rotation of the rotary processing member so as to disrupt material tending to pass to the drive shaft.

21. Rotary processing apparatus of the type including a drive shaft extending from a fixed wall to an adjacent wall of a processing member driven for rotation by the drive shaft, the rotary processing apparatus including:-

a barrier wall mounted on one of said fixed or adjacent walls about the drive shaft and terminating close to the other wall, and

complementary disrupting members extending from respective said fixed and adjacent walls so as to pass closely adjacent one another upon rotation of the adjacent wall relative to the fixed wall.

22. A rotary processor such as garden refuse shredder having a driven shaft driving a shredder mounted within a housing, an inlet to the housing for refuse to be shredded and an outlet from the housing for discharging shredded refuse, wherein:-

impeller means are associated with the shredder for inducing an inflow to the housing through the inlet and an outflow from the housing through the outlet.

23. Garden refuse shredding apparatus including:-

a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads the or each respective chipper blade;

a feed hopper for directing refuse into the chamber in the path of the chipper blade or blades;

an electric motor for rotating the rotor;

a friction brake biased to an engaged attitude with the shredding rotor so as to cause the shredding rotor to slow quickly once electrical power to the driving motor has ceased;

a manual on/off control associated with an onboard electrical switch which controls the supply of electricity to the electric motor and with the friction brake whereby movement of the control to the on position for supplying electricity to the motor moves the friction brake from its engaged attitude to a disengaged attitude.

24. Garden refuse shredding apparatus as claimed in claim 22, wherein the friction brake includes a single brake shoe carried on a lever for movement to and from its engaged attitude and wherein the lever co-operates with an electrical switch in its disengaged position to supply electricity to the motor.

25. Garden refuse shredding apparatus as claimed in claim 24, wherein the friction brake is suitably arranged as a leading shoe brake.

26. Garden refuse shredding apparatus as claimed in any one of claims 23 to 25, wherein the shredding rotor is supported within a shredder housing which is opened to provide service access to the shredding rotor and a latching arrangement is provided for holding the brake lever or other manual on/off control when in the on position in a blocking position blocking the opening of the shredder housing.

27. Garden refuse shredding apparatus including:-

a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads the or each respective chipper blade;

- a feed hopper for directing refuse into the chamber in the path of the chipper
- 5 blade or blades, and
- drive means for rotating the rotor.

AMENDED CLAIMS

[received by the International Bureau on 2 February 2000 (02.02.00);
original claims 9, 10 and 14 amended;
new claims 28 to 31 added; remaining claims unchanged (7 pages)]

1. Garden refuse shredding apparatus including:-
 - a chamber having a refuse inlet and an outlet for shredded material;
 - a fan for creating an outflow of air from said outlet
 - a shredding rotor supported for rotation in the chamber;
 - at least one elongate chipper blade fixed for rotation with the rotor and extending inward from adjacent the outer periphery of the rotor;
 - a respective blade aperture through the rotor in front of the or each chipper blade through which material shredded by the chipper blade may pass;
 - a feed hopper for directing refuse through said refuse inlet into the chamber in the path of the chipper blade or blades. and
 - drive means for rotating the rotor.
2. Garden refuse shredding apparatus as claimed in claim 1, wherein:-
 - the fan includes fan blades supported on the rotor and induces an air flow through the feed hopper so as to assist in induction of material introduced to the feed hopper into the housing;
 - the chamber is formed so as to provide an expanding outflow passage to said outlet, and
 - each elongate chipper blade extends inward from adjacent the outer periphery of the rotor substantially to or beyond the half radius position on the rotor.
3. Garden refuse shredding apparatus as claimed in claim 1 or claim 2, wherein the shredding rotor is supported for rotation about an upstanding axis, the feed hopper extends upwardly from an upper end wall of the chamber and the fan blades are mounted on the shredding rotor at the side thereof remote from the feed hopper.

4. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the shredding rotor is mounted for direct drive from the output shaft of the drive motor.
5. Garden refuse shredding apparatus as claimed in claim 4, wherein the drive motor is a vertical crankshaft internal combustion engine supported above the chamber, and wherein the shredding rotor is fixed to a hub which rotates with the output shaft of the motor and which is supported by a bearing independent of the motor.
6. Garden refuse shredding apparatus as claimed in claim 5, wherein both the motor and the bearing supporting the hub are supported by the upper end wall of the chamber.
7. Garden refuse shredding apparatus as claimed in any one of claims 4 to 6, wherein the bearing supporting said hub isolates the end and radial loads applied by the shredding rotor from the engine.
8. Garden refuse shredding apparatus as claimed in any one of claims 4 to 7, wherein the bearing is a self-aligning bearing which is locked to the hub.
9. Garden refuse shredding apparatus as claimed in any one of claims 5 to 8, wherein the engine is supported in spaced relationship above the hub and the feed hopper directs refuse through a lower inclined portion extending inward beneath the engine to said refuse inlet.
10. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the drive motor is an electric motor and the rotor is driven directly from the output shaft of the motor.
11. Garden refuse shredding apparatus as claimed in any one of claims 3 to 10, wherein the shredding rotor is suspended from a nominally horizontal upper

end wall of an upper housing part within a chamber formed between the upper housing part and a lower housing part and wherein the housing parts may be separated to expose the shredding rotor.

12. Garden refuse shredding apparatus as claimed in claim 11, wherein the upper end wall also supports the motor and the hopper and wherein the upper housing part is hingedly connected to the lower housing part for pivotal separation to expose the shredding rotor.

13. Garden refuse shredding apparatus as claimed in claim 12, wherein the lower housing part is supported on skids or wheels.

14. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein:

the chamber has an end wall extending across the blade mounting face of rotor and through which the feed hopper directs refuse into the chamber;

an annular barrier wall is fixed to said end wall and extends about the portion of the hub exposed between said end wall and the rotor;

complementary disrupting members are supported on the end wall and the rotor outwardly of the annular barrier wall but inwardly of the chipper blades, the complementary disrupting members forming stationary members and fixed rotor members respectively which pass closely adjacent one another upon rotation of the rotor.

15. Garden refuse shredding apparatus as claimed in claim 14, wherein each said fixed member is a substantially cylindrical projection extending from said end wall and each said stationary members is a blade member which passes closely adjacent the outer and end faces of the cylindrical projection.

16. Garden refuse shredding apparatus as claimed in claim 15, wherein the cylindrical head of a high tensile cap screw or bolt passing through said end wall forms a said cylindrical projection.

17. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the chamber is a volute shaped chamber which provides an expanding path for shredded refuse to an outlet from the chamber.

18. Garden refuse shredding apparatus as claimed in any one of the preceding claims and including an anvil across the trailing end of said inlet which cooperates with said chipper blades.

19. Garden refuse shredding apparatus as claimed in any one of the preceding claims, wherein the inlet and each chipper blade extends across two-thirds of the rotor's radial extent.

20. A method of inhibiting entwinement of elongate articles about the drive shaft of rotary processing members, the method including:-

forming a barrier wall about the drive shaft to substantially conceal access between the walls from and to which the drive shaft extends to the rotary processing member, and

providing complementary disrupting members on the respective walls from and to which the drive shaft extends to the rotary processing member, the disrupting members comprising fixed and stationary members which pass closely adjacent one another upon rotation of the rotary processing member so as to disrupt material tending to pass to the drive shaft.

21. Rotary processing apparatus of the type including a drive shaft extending from a fixed wall to an adjacent wall of a processing member driven for rotation by the drive shaft, the rotary processing apparatus including:-

a barrier wall mounted on one of said fixed or adjacent walls about the drive shaft and terminating close to the other wall, and

complementary disrupting members extending from respective said fixed and adjacent walls so as to pass closely adjacent one another upon rotation of the adjacent wall relative to the fixed wall.

22. A rotary processor such as garden refuse shredder having a driven shaft driving a shredder mounted within a housing, an inlet to the housing for refuse to be shredded and an outlet from the housing for discharging shredded refuse, wherein:-

impeller means are associated with the shredder for inducing an inflow to the housing through the inlet and an outflow from the housing through the outlet.

23. Garden refuse shredding apparatus including:-

a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads the or each respective chipper blade;

a feed hopper for directing refuse into the chamber in the path of the chipper blade or blades;

an electric motor for rotating the rotor;

a friction brake biased to an engaged attitude with the shredding rotor so as to cause the shredding rotor to slow quickly once electrical power to the driving motor has ceased;

a manual on/off control associated with an onboard electrical switch which controls the supply of electricity to the electric motor and with the friction brake whereby movement of the control to the on position for supplying electricity to the motor moves the friction brake from its engaged attitude to a disengaged attitude.

24. Garden refuse shredding apparatus as claimed in claim 22, wherein the friction brake includes a single brake shoe carried on a lever for movement to and from its engaged attitude and wherein the lever co-operates with an electrical switch in its disengaged position to supply electricity to the motor.

25. Garden refuse shredding apparatus as claimed in claim 24, wherein the friction brake is suitably arranged as a leading shoe brake.

26. Garden refuse shredding apparatus as claimed in any one of claims 23 to 25, wherein the shredding rotor is supported within a shredder housing which is opened to provide service access to the shredding rotor and a latching arrangement is provided for holding the brake lever or other manual on/off control when in the on position in a blocking position blocking the opening of the shredder housing.

27. Garden refuse shredding apparatus including:-

- a shredding rotor supported for rotation in a chamber and having one or more chipper blades adjacent its outer periphery and a blade aperture through the rotor which leads the or each respective chipper blade;

- a feed hopper for directing refuse into the chamber in the path of the chipper blade or blades, and
- drive means for rotating the rotor.

28. Garden refuse shredding apparatus including:-

- a chamber confined by a housing having a refuse inlet and an outlet for shredded material;

- a shredding rotor supported for rotation in the chamber;

- at least one elongate chipper blade fixed for rotation with the shredding rotor and extending inward from adjacent the outer periphery of the rotor;

- a respective blade aperture through the rotor in front of the or each chipper

- blade through which material shredded by the chipper blade may pass for discharge through the outlet;

- a refuse feed hopper having a lower inclined portion which extends inwardly to the refuse inlet for directing refuse through said refuse inlet into the chamber in the path of the chipper blade or blades;

a fan having fan blades supported on the rotor for inducing an air flow through the or each blade aperture and the feed hopper;

an extension shaft fixed for rotation with the output shaft of a vertical crankshaft internal combustion engine and extending from the engine to the rotor through a bearing mounted by the chamber housing and supporting the rotor, and wherein:

the or each elongate chipper blade, the associated blade aperture and the refuse inlet extend inward from adjacent the outer periphery of the rotor substantially to or beyond the half radius position of the rotor;

the vertical crankshaft internal combustion engine is elevated above the chamber so as to clear the lower inclined portion of the feed hopper.

29. Garden refuse shredding apparatus as claimed in claim 28, wherein the chamber is formed so as to provide an expanding outflow passage to said outlet.

30. Garden refuse shredding apparatus as claimed in claim 28 or claim 29 and wherein the fan includes a fan blade which extends from an inner position adjacent the inner end of each blade aperture to an outer position adjacent the outer periphery of the rotor and trailing the inner position of the fan blade.

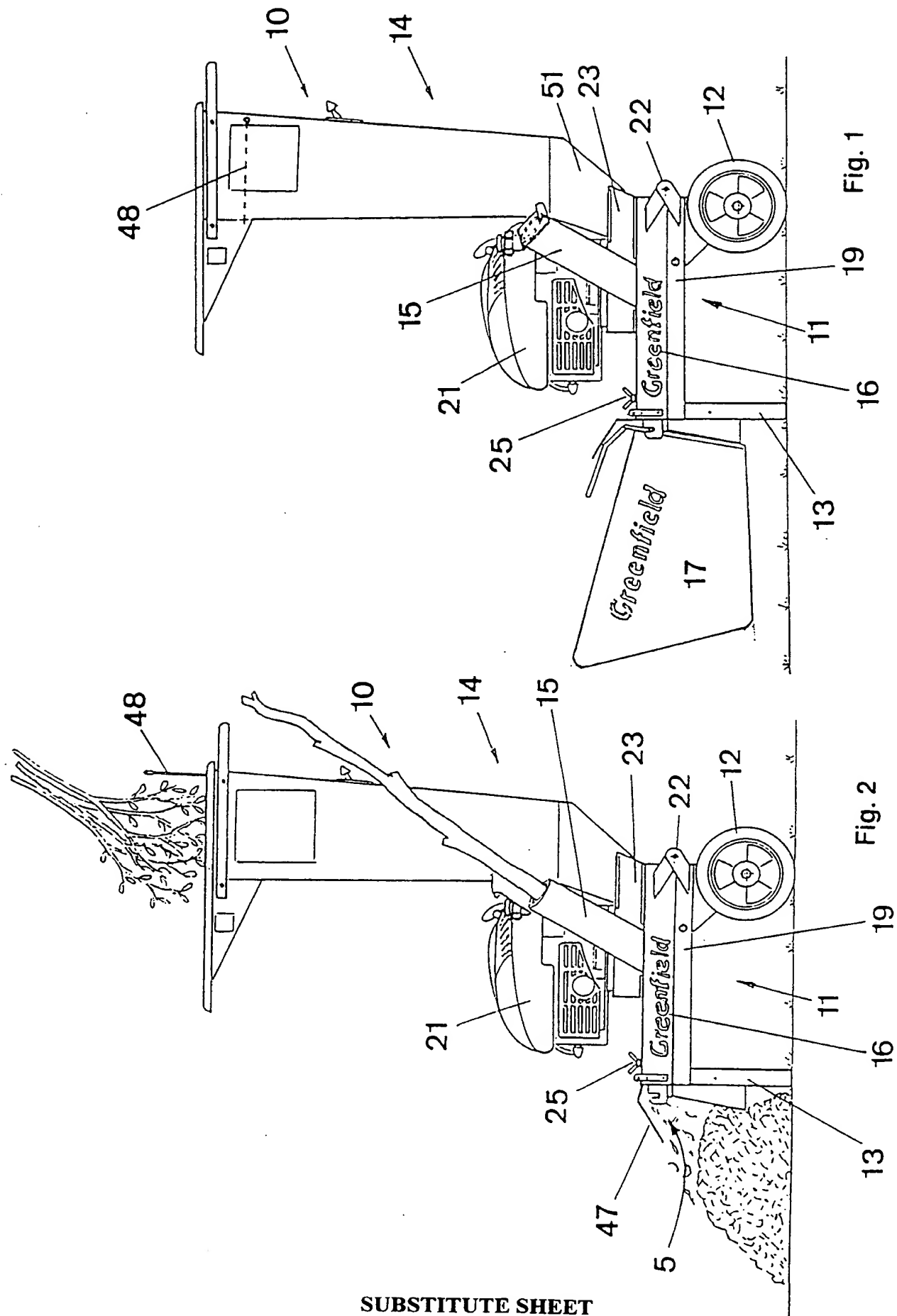
31. Garden refuse shredding apparatus as claimed in any of claims 28 to 30, wherein:

the chamber housing has an end wall extending across the blade mounting face of rotor and through which the refuse inlet extends;

an annular barrier wall is fixed to the end wall and extends about the extension shaft exposed between the end wall and the rotor, and

complementary disrupting members are supported on the end wall and the rotor outwardly of the annular barrier wall but inwardly of the chipper blades, the complementary disrupting members forming stationary members and fixed rotor members respectively which pass closely adjacent one another upon rotation of the rotor.

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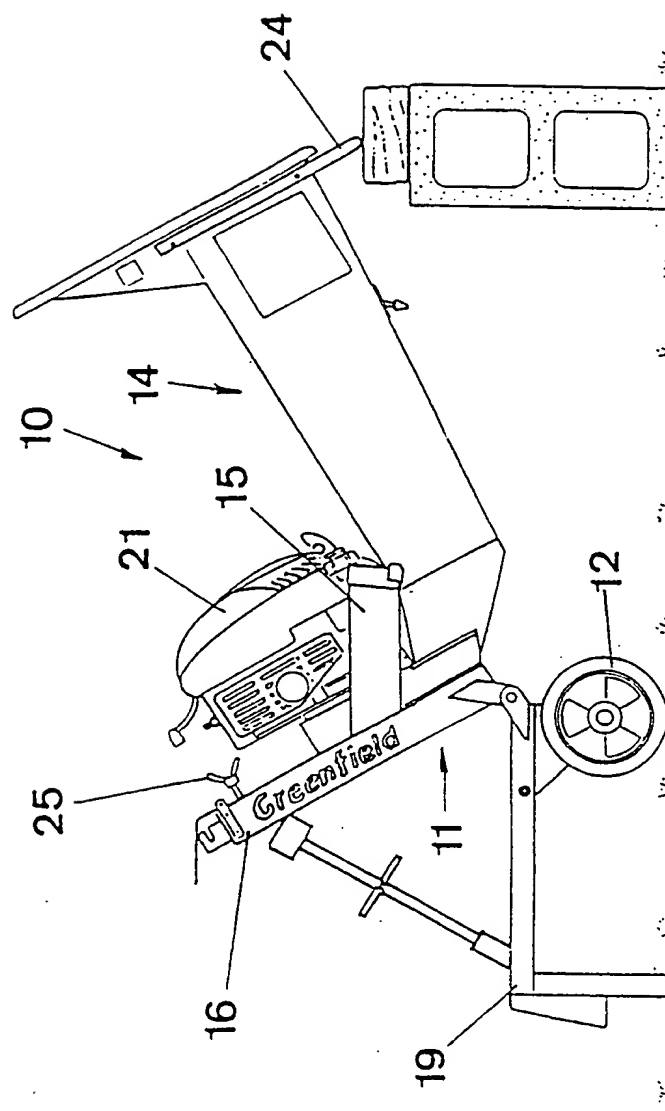
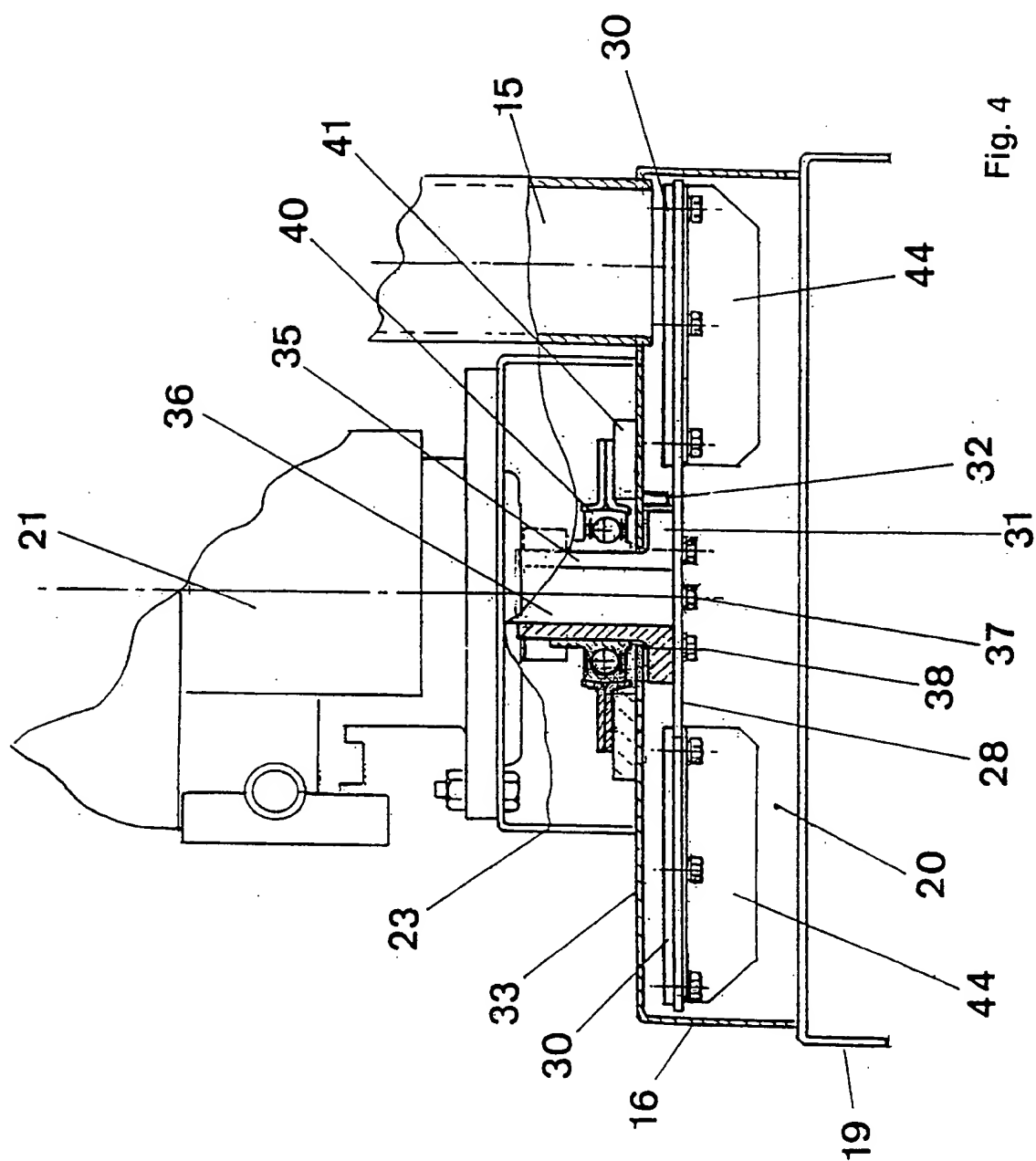


Fig. 3



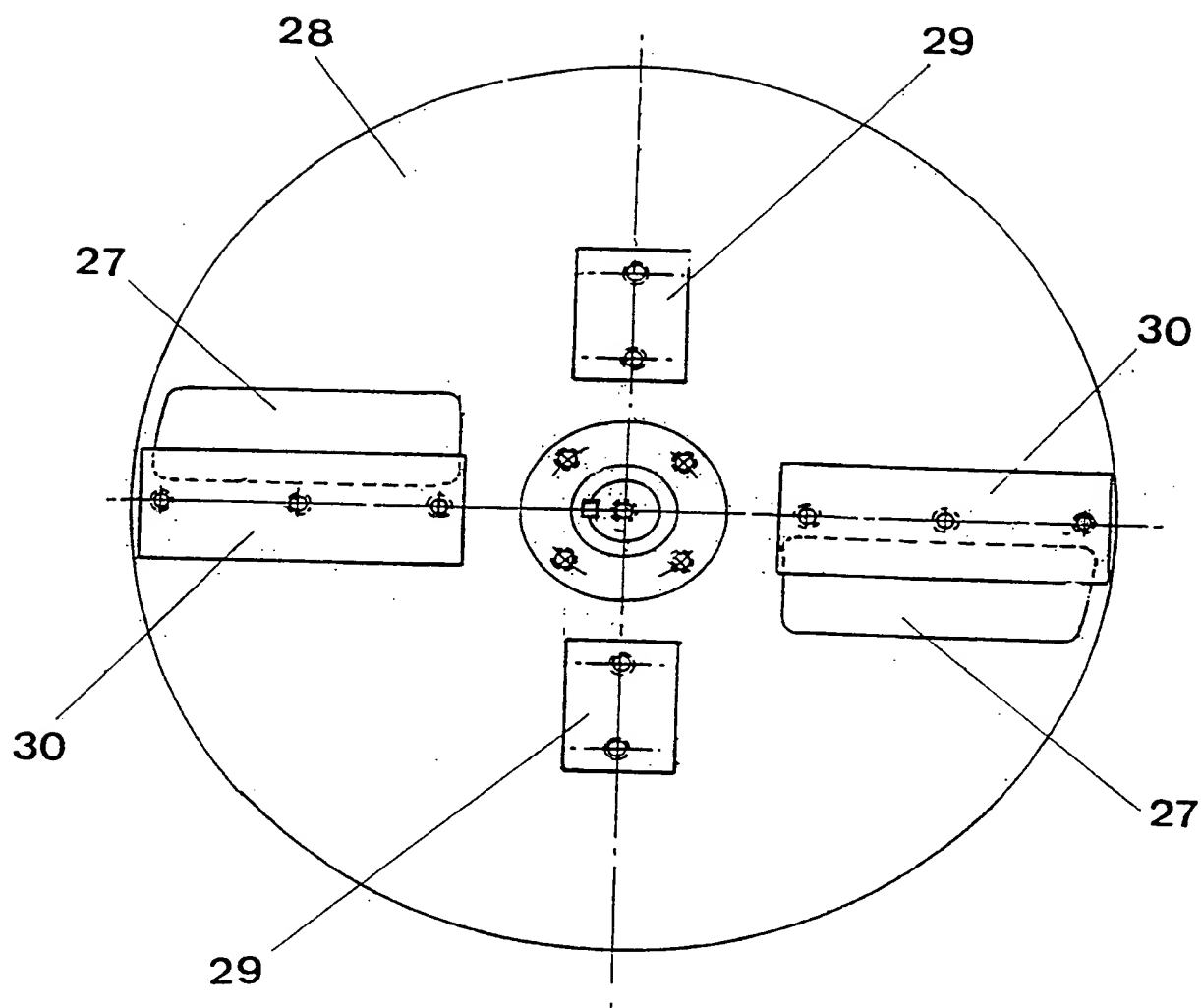


Fig. 5

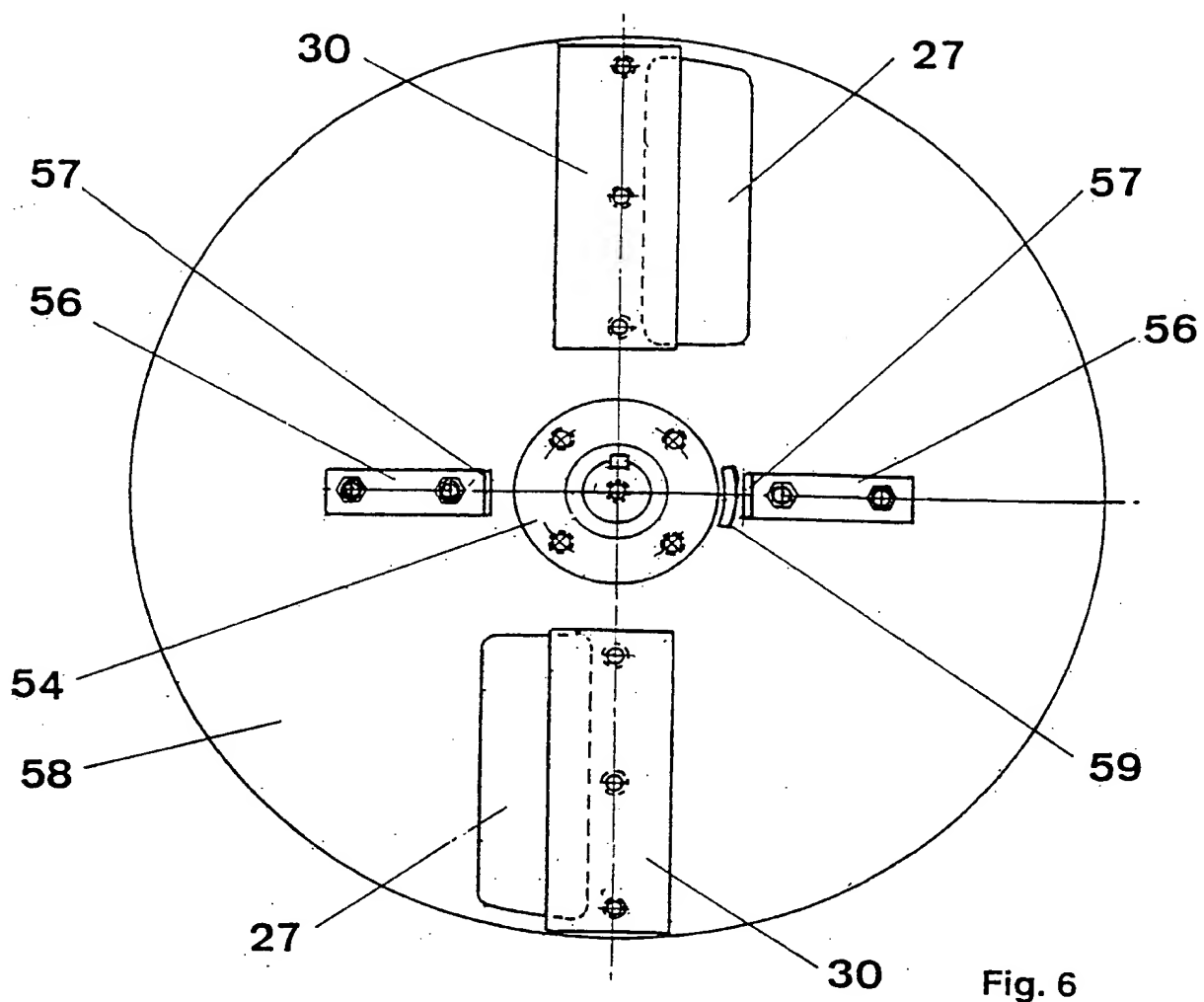


Fig. 6

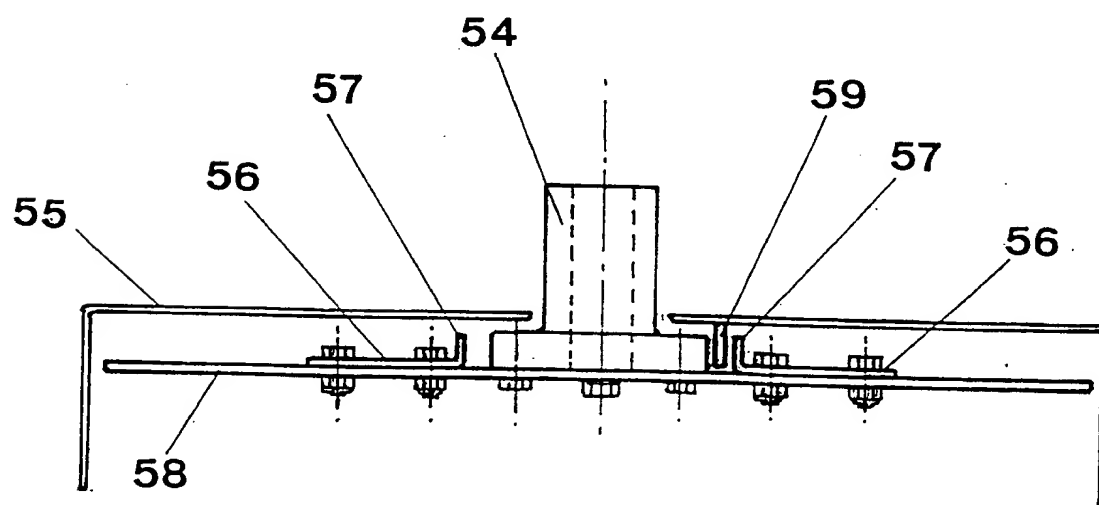


Fig. 7

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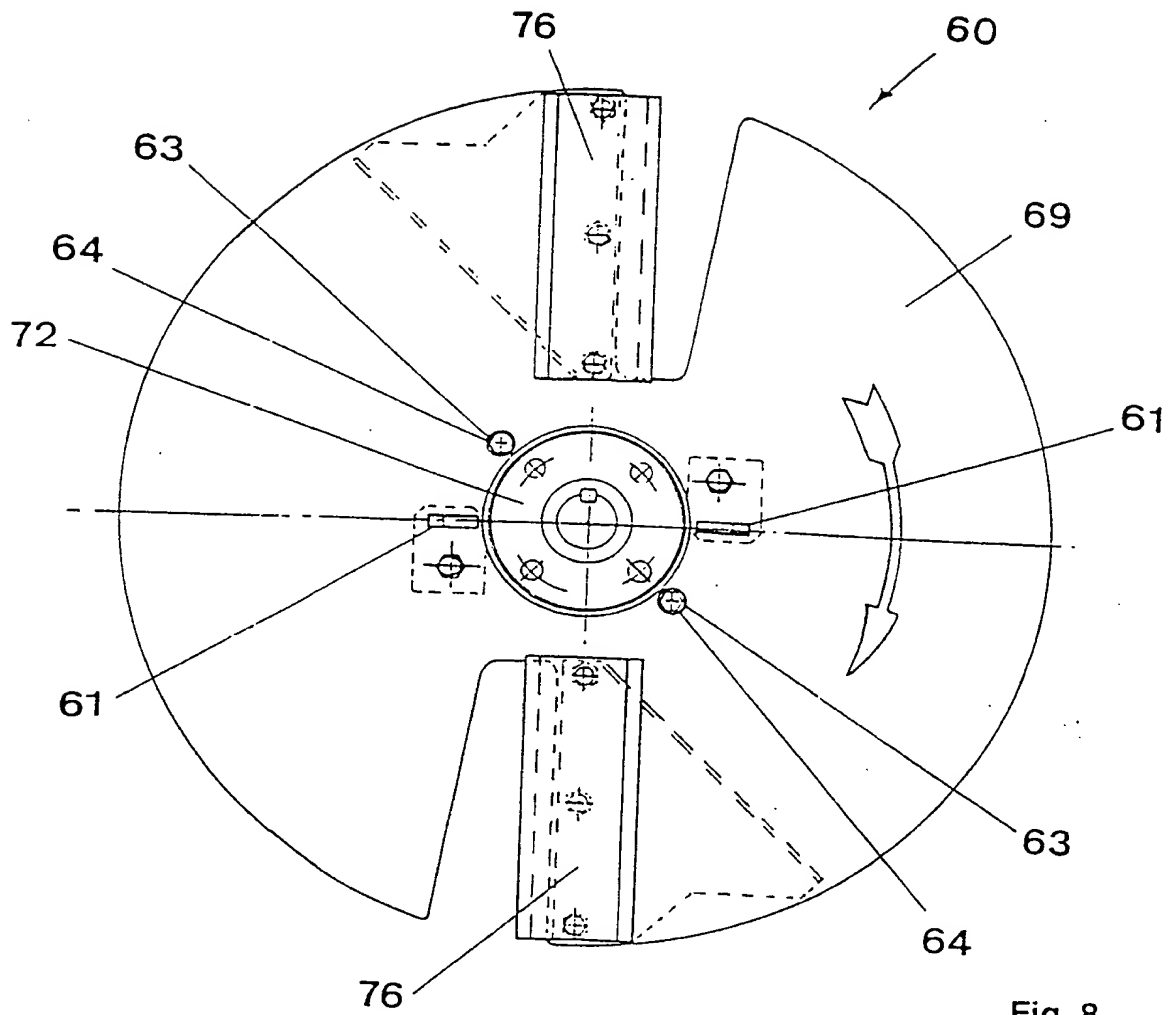


Fig. 8

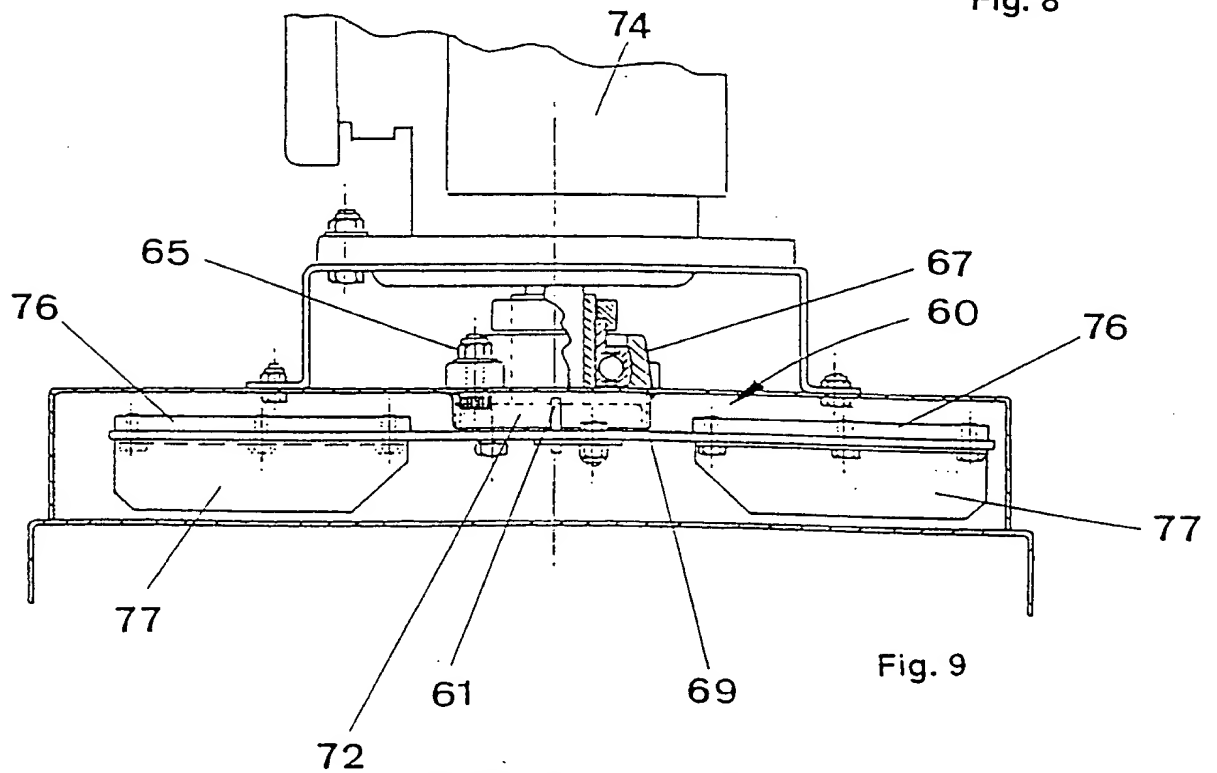
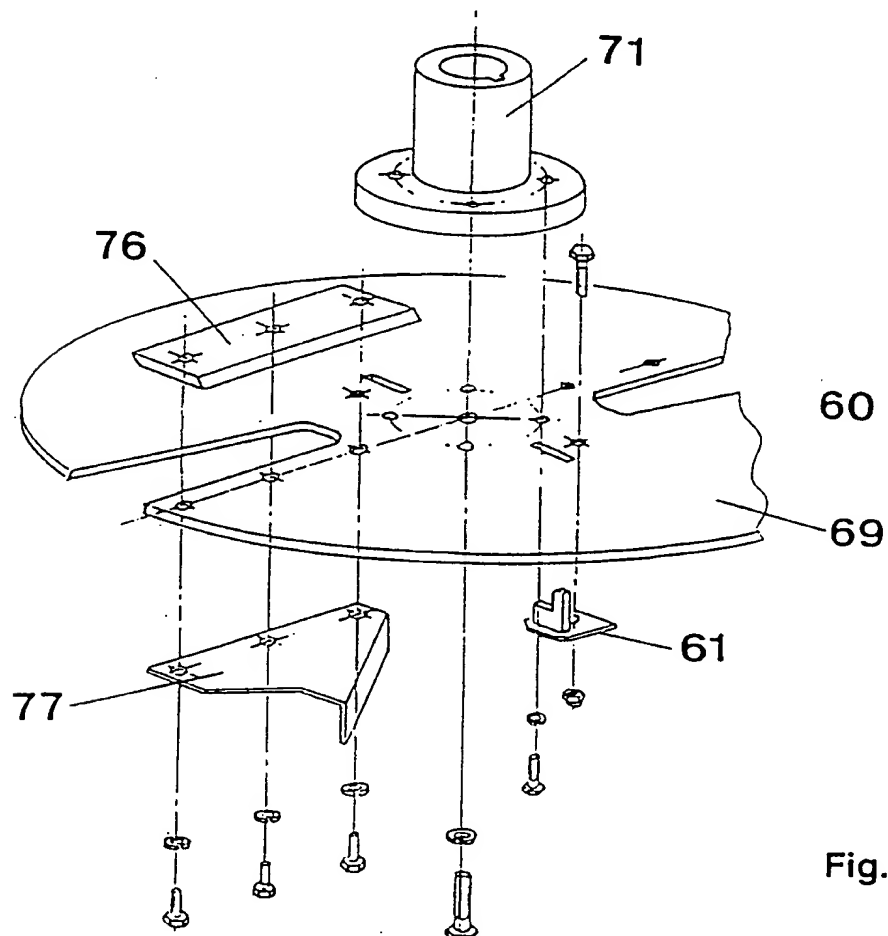
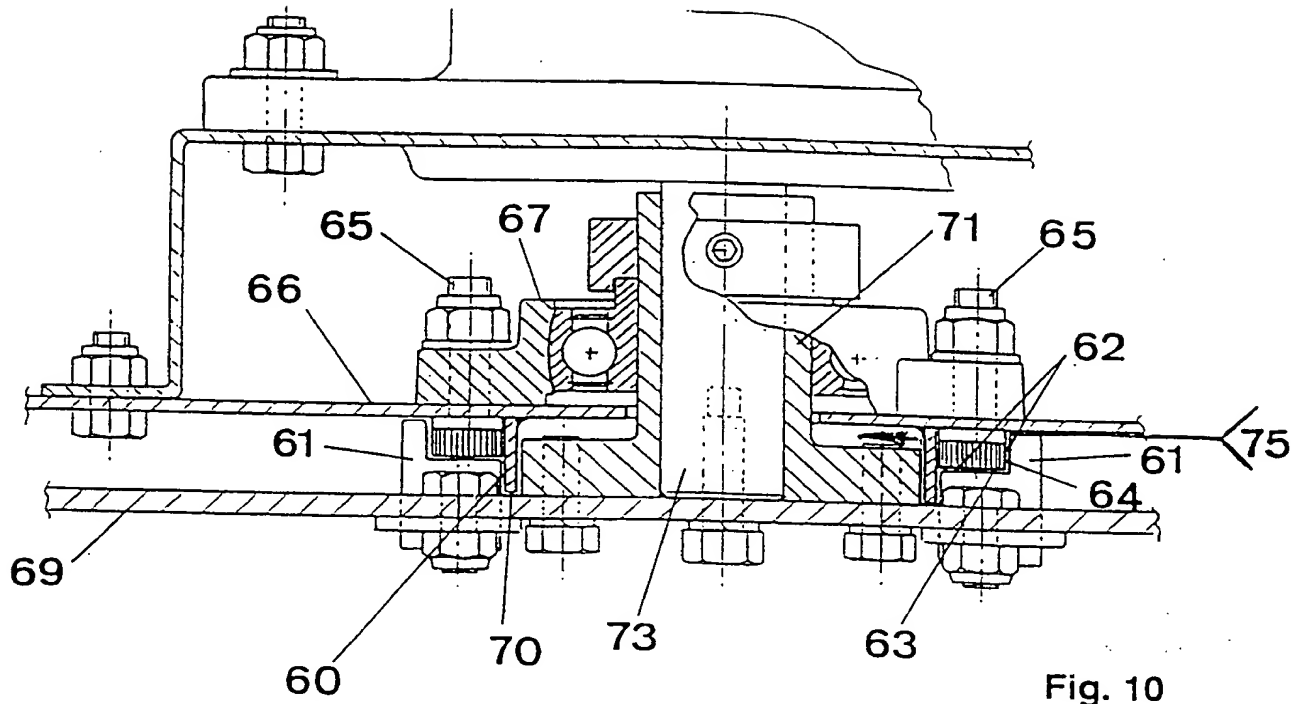


Fig. 9



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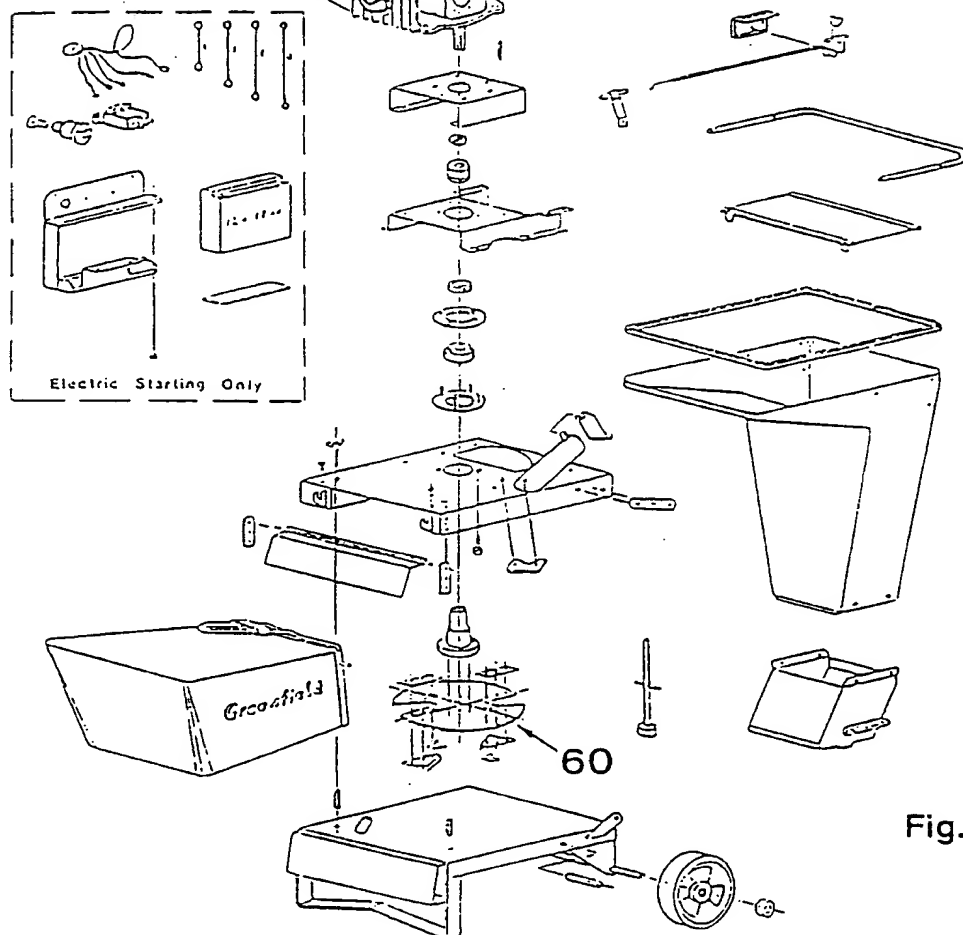


Fig. 12

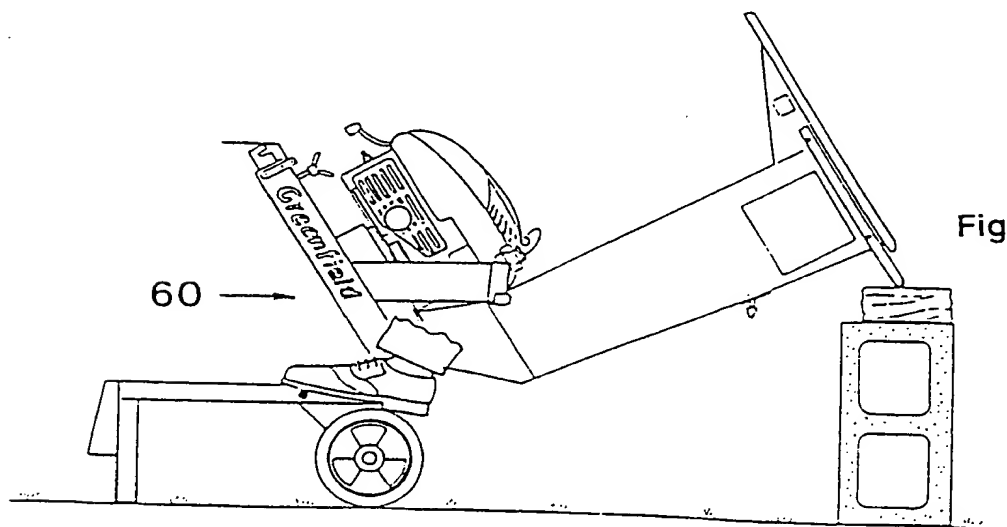


Fig. 13

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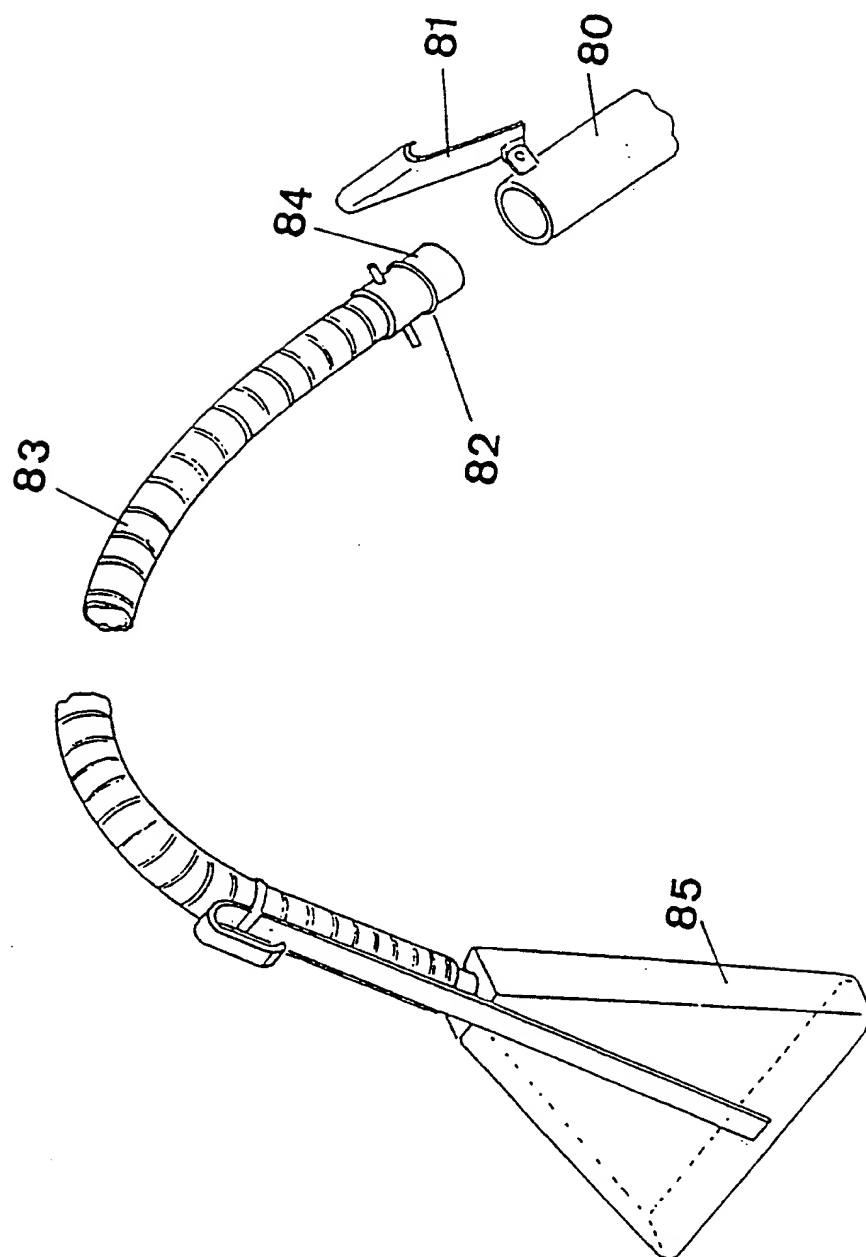


Fig. 14

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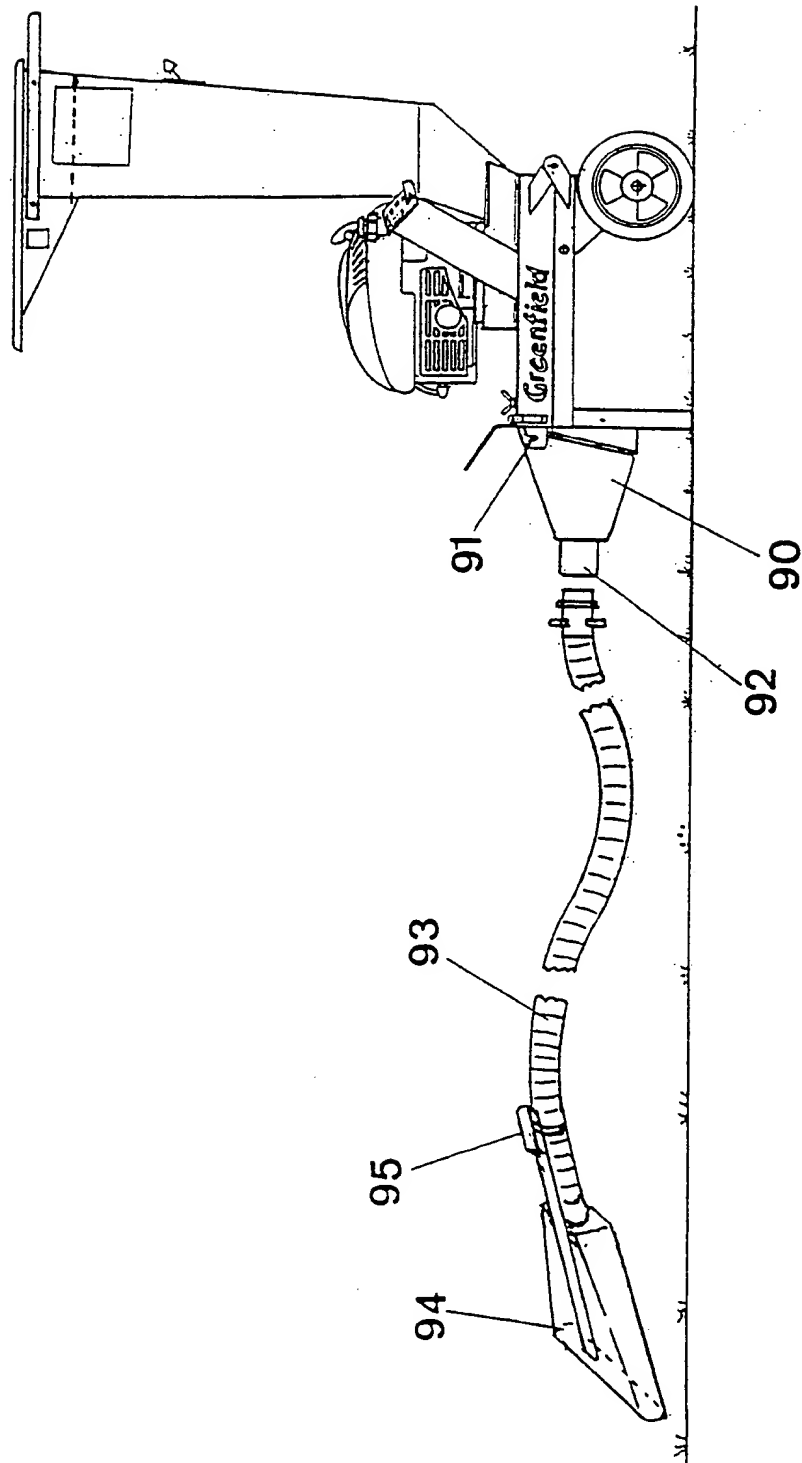


Fig. 15

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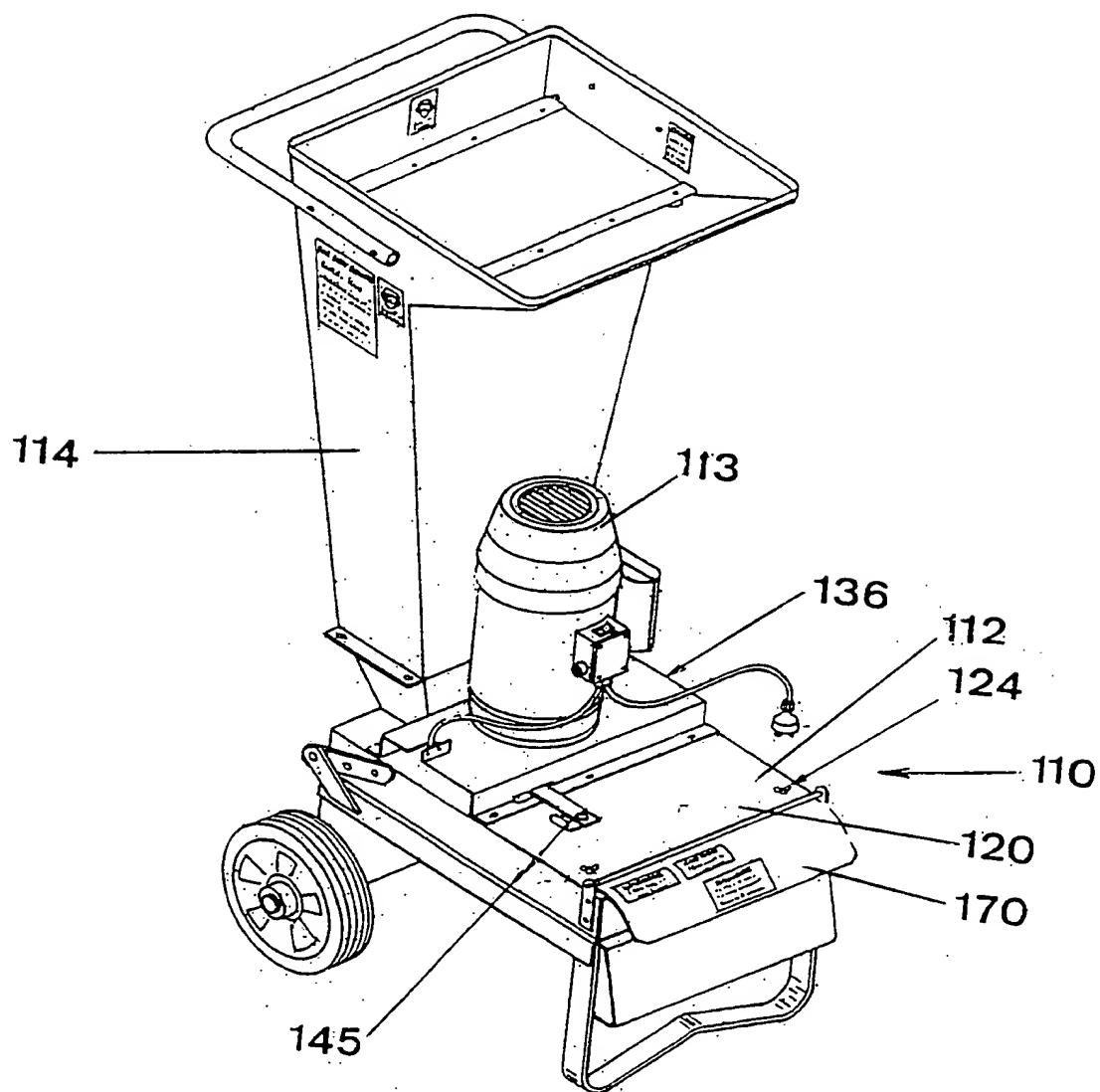


Fig. 16

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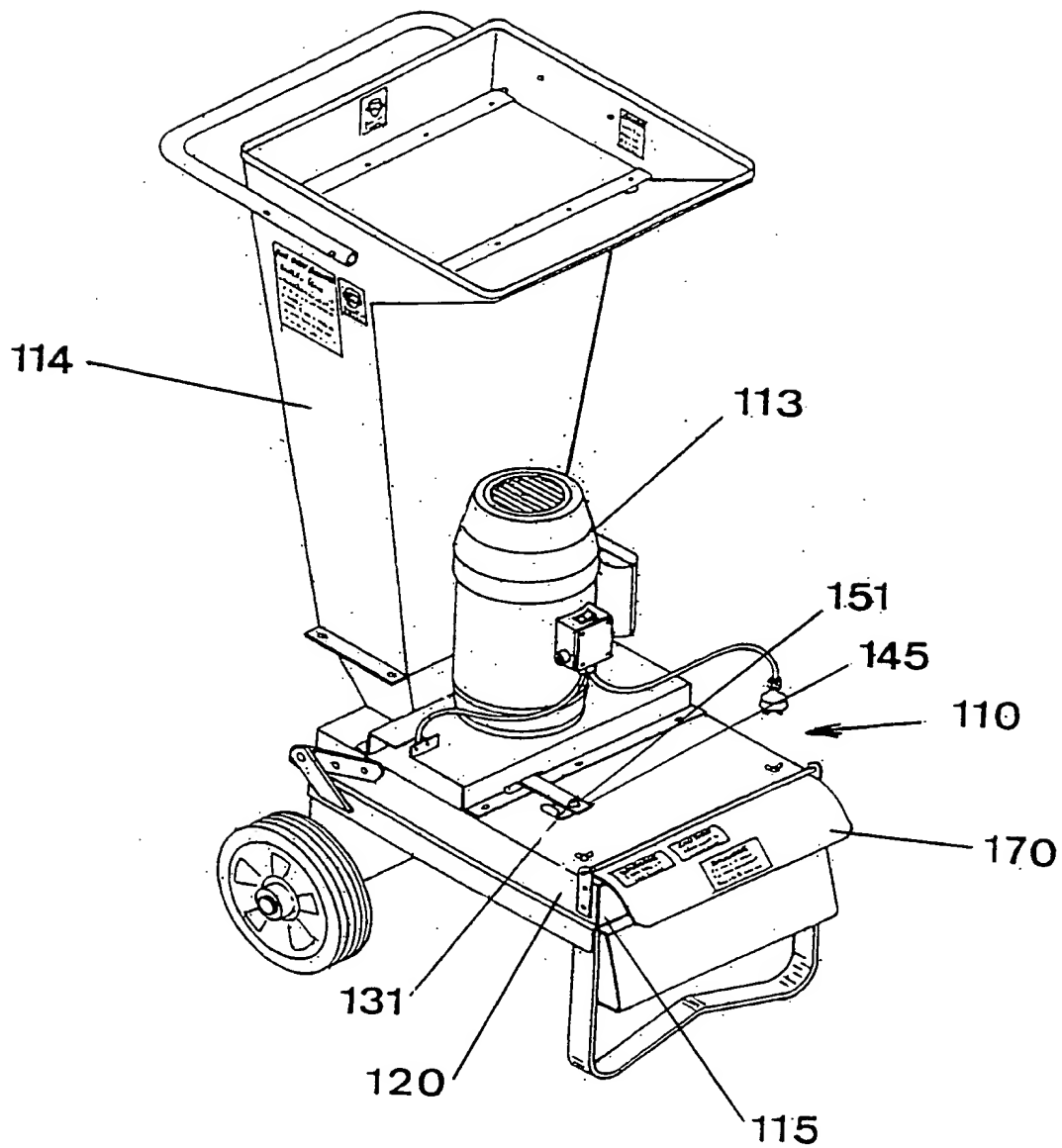


Fig. 17

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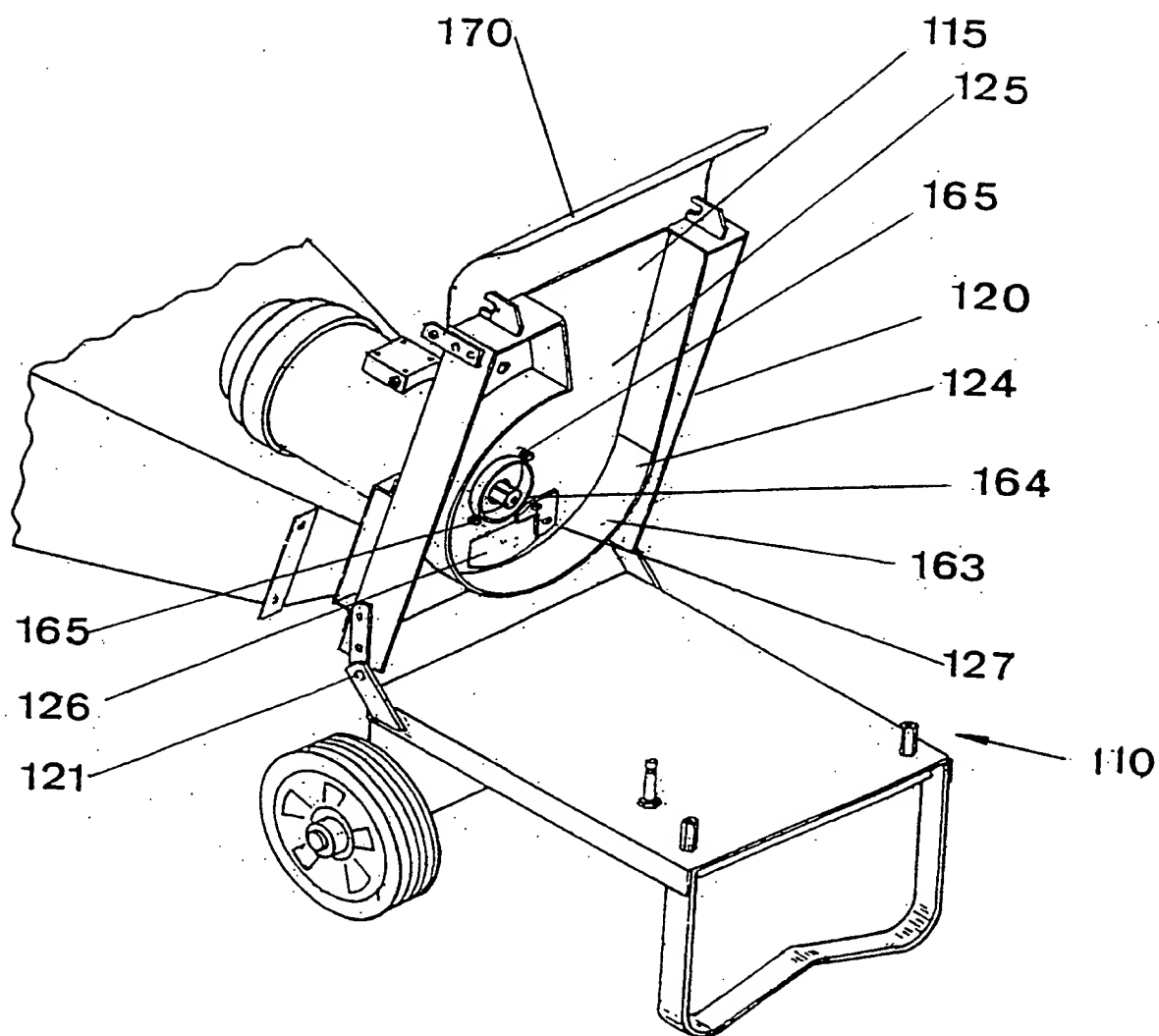


Fig. 18

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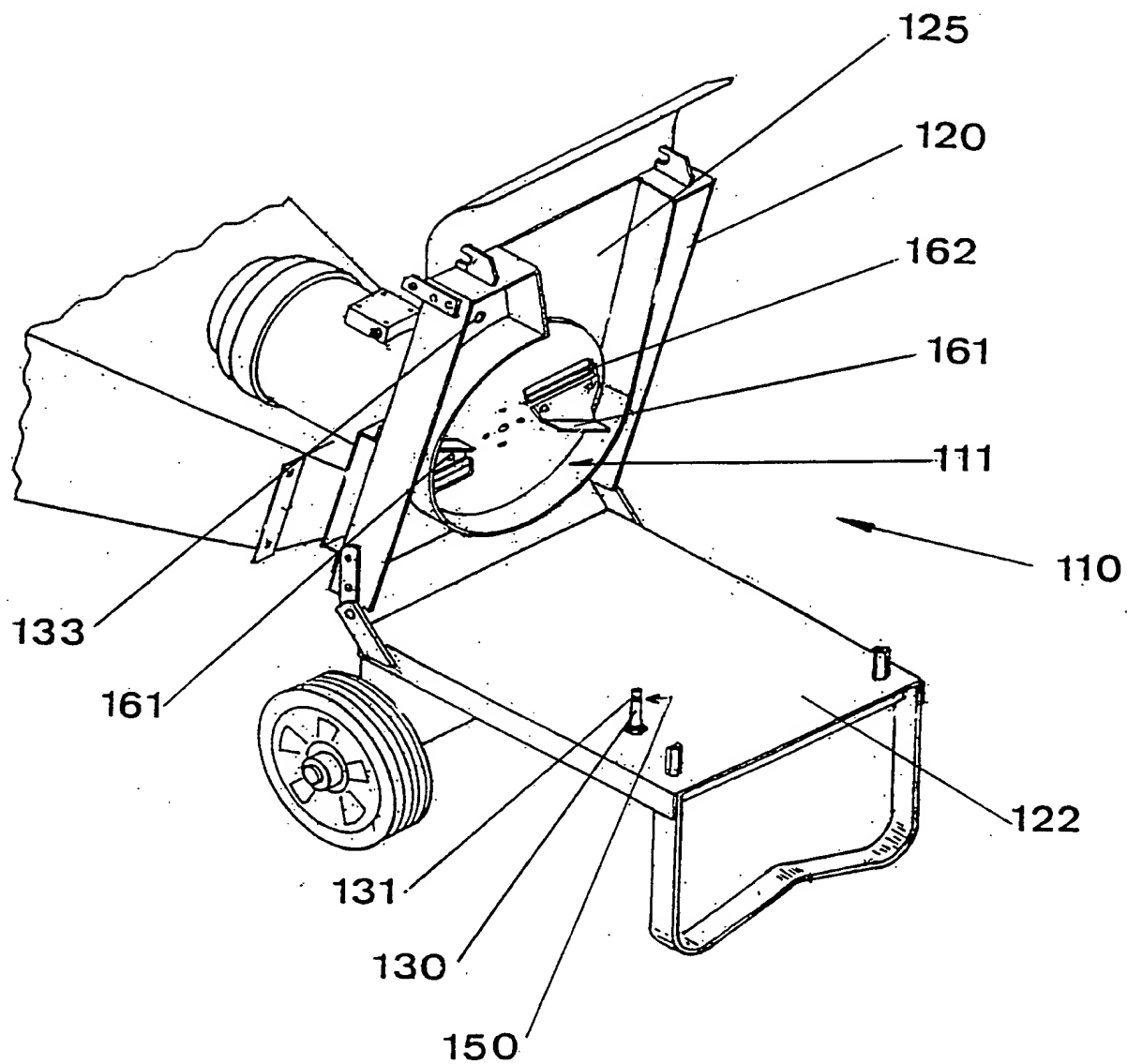


Fig. 19

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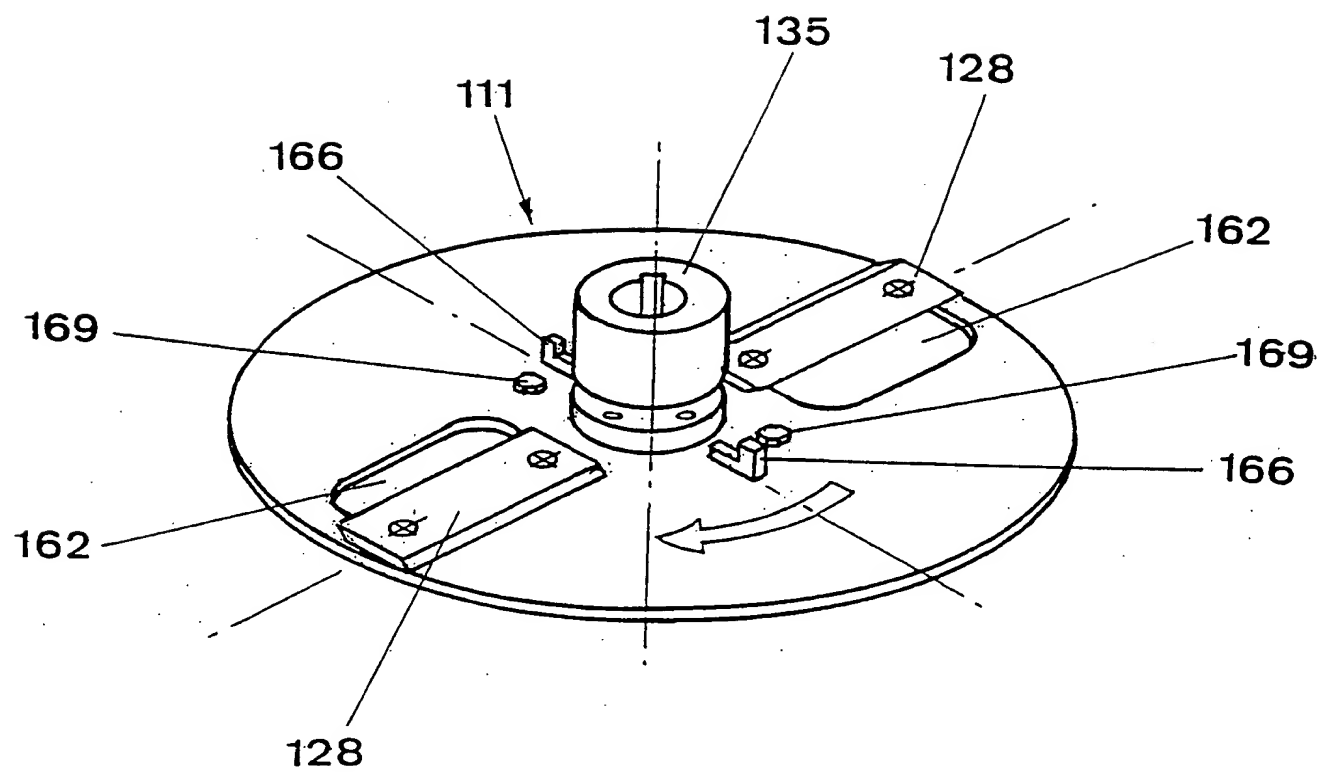


Fig. 20

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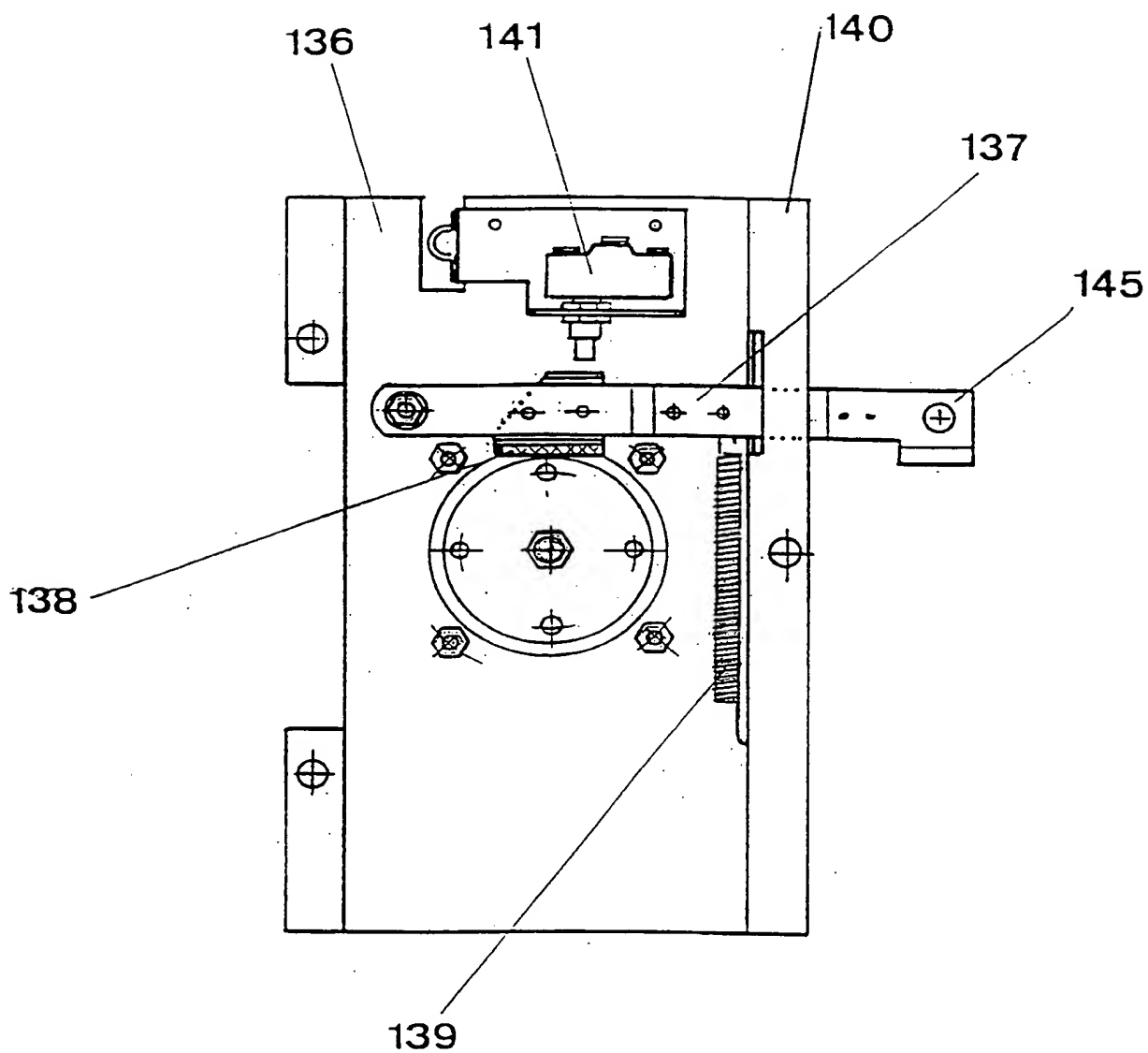


Fig. 21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU99/00727

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁶: B02C 18/10, 18/14, 18/40, 23/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B02C 18/10, 18/14, 18/40, 23/04, 23/24, 23/28

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT: airflow: OR AIR OR FAN:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5215266 A (ZIMMERMAN) 1 June 1993 Column 1 lines 31 - 68, drawings, abstract.	1 - 19, 22
X	GB 2261616 A (CONNOLLY) 28 May 1993 See Whole document	1 - 19, 22
X	GB 2259872 A (BOLD) 31 March 1993 See whole document	1 - 19, 22

☐ Further documents are listed in the
continuation of Box C

☐ See patent family annex

* Special categories of cited documents:

"A" Document defining the general state of the art which is
not considered to be of particular relevance
"E" earlier application or patent but published on or after the
international filing date
"L" document which may throw doubts on priority claim(s)
or which is cited to establish the publication date of
another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition
or other means
"P" document published prior to the international filing date
but later than the priority date claimed

"T" later document published after the international filing date or
priority date and not in conflict with the application but cited to
understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot
be considered novel or cannot be considered to involve an
inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot
be considered to involve an inventive step when the document is
combined with one or more other such documents, such
combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
08 December 1999

Date of mailing of the international search report
21 DEC 1999

Name and mailing address of the ISA/AU
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Facsimile No.: (02) 6285 3929

Authorized officer

MIKE BREMERS

Telephone No.: (02) 6283 2052

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/AU99/00727

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1 and 22 are directed to a garden refuse apparatus including a fan for creating an outflow of air from the outlet for shredded material.
 2. Claims 20 and 21 are directed to providing disrupting members on the respective walls from and to which the drive shaft extends to the rotary-processing member.
 3. Claim 23 is directed to a manual on/off control associated with an on board electrical switch.
 4. Claim 27 is directed to a combination of known features.
1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
 2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
 4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1 - 19, 22

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference BAR00032	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">FOR FURTHER ACTION</div> <div style="text-align: right; font-size: small;">see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</div> </div>	
International application No. PCT/AU99/00727	International filing date (<i>day/month/year</i>) 03 September 1999	(Earliest) Priority Date (<i>day/month/year</i>) 03 September 1998
Applicant 1. BARTLEM PTY LTD		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of **3** sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international application, the international search was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority in written form.
 - ☐ furnished subsequently to this Authority in computer readable form.
 - ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
- ☐ Certain claims were found unsearchable (See Box I).
- ☒ **Unity of invention is lacking (See Box II).**

4. With regard to the title, ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established by this Authority to read as follows:
5. With regard to the abstract, ☒ the text is approved as submitted by the applicant
- ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is Figure No. **1**
- ☒ as suggested by the applicant.
 ☐ because the applicant failed to suggest a figure
 ☐ because this figure better characterizes the invention
 ☐ None of the figures

Box 1 Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

The International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1 and 22 are directed to a garden refuse apparatus including a fan for creating an outflow of air from the outlet for shredded material.
2. Claims 20 and 21 are directed to providing disrupting members on the respective walls from and to which the drive shaft extends to the rotary-processing member.
3. Claim 23 is directed to a manual on/off control associated with an on board electrical switch.
4. Claim 27 is directed to a combination of known features.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1 - 19, 22

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU99/00727**A. CLASSIFICATION OF SUBJECT MATTER**Int Cl⁶: B02C 18/10, 18/14, 18/40, 23/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
B02C 18/10, 18/14, 18/40, 23/04, 23/24, 23/28Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as aboveElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: airflow: OR AIR OR FAN:**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5215266 A (ZIMMERMAN) 1 June 1993 Column 1 lines 31 - 68, drawings, abstract.	1 - 19, 22
X	GB 2261616 A (CONNOLLY) 28 May 1993 See Whole document	1 - 19, 22
X	GB 2259872 A (BOLD) 31 March 1993 See whole document	1 - 19, 22

☐ Further documents are listed in the
continuation of Box C☐ See patent family annex

* Special categories of cited documents:	
"A" Document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
08 December 1999

Date of mailing of the international search report

21 DEC 1999

Name and mailing address of the ISA/AU
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WODEN ACT 2606 AUSTRALIA
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Authorized officer

MIKE BREMERS
Telephone No.: (02) 6283 2052

5


PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 13 FEB 2001	
WIPO	PCT

Applicant's or agent's file reference BAR00032		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. PCT/AU 99/00727	International filing date (day/month/year) 03 September 1999	Priority Date (day/month/year) 03 September 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ B02C 18/10, 18/14, 18/40, 23/04		
Applicant 1. BARTLEM PTY LTD et al		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u>5</u> sheets, including this cover sheet. <input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of _____ sheet(s).
3.	This report contains indications relating to the following items: I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 03 April 2000	Date of completion of the report 08 January 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  ASOKA DIAS-ABEYGUNAWARDENA Telephone No. (02) 6283 2141

I. Basis of the report**1. With regard to the elements of the international application:***

- ☒ the international application as originally filed.
- ☐ the description, pages , as originally filed,
 pages , filed with the demand,
 pages , received on with the letter of .
- ☐ the claims, pages , as originally filed,
 pages , as amended (together with any statement) under Article 19,
 pages , filed with the demand,
 pages , received on with the letter of .
- ☐ the drawings, pages , as originally filed,
 pages , filed with the demand,
 pages , received on with the letter of .
- ☐ the sequence listing part of the description:
 pages , as originally filed
 pages , filed with the demand
 pages , received on with the letter of .

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, was on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be nonobvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos.: **20, 21, 23-27**

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claim Nos. **20, 21, 23-27**

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☒ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

1. Claims 1 and 22 are directed to a garden refuse apparatus including a fan for creating an outflow of air from the outlet for shredded material.
2. Claims 20 and 21 are directed to providing disrupting members on the respective walls from and to which the drive shaft extends to the rotary-processing members.
3. Claim 23 is directed to a manual on/off control associated with an on board electrical switch.
4. Claim 27 is directed to a combination of known features.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-19, 22

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	YES
	Claims 1-19, 22	NO
Inventive step (IS)	Claims	YES
	Claims 1-19, 22	NO
Industrial applicability (IA)	Claims 1-19, 22	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)**NOVELTY (N)**

Claims 1-19, 22

US 5215266 A (ZIMMERMAN) 1 June 1993

GB 226 1616 A (CONNOLLY) 28 May 1993

GB 225 9872 A (BOLD) 31 March 1993

The citations disclose all of the features of the above claims.

INVENTIVE STEP (IS)

Claim 1-19, 22: as above.